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ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP), EUROPE

FOR

DEPARTMENT OF THE ARMY
EUROPE DIVISION, CORPS OF ENGINEERS

BY

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ENERGY ENGINEERING ANALYSIS (EEA) PROGRAM

EUROPE

MIESAU AMMO DEPOT

ZWEIBRUECKEN MILITARY COMMUNITY

19971023 109

VOLUME I: EXECUTIVE SUMMARY

FINAL SUBMISSION

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VOLUME I - EXECUTIVE SUMMARY

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1.0 INTRODUCTION

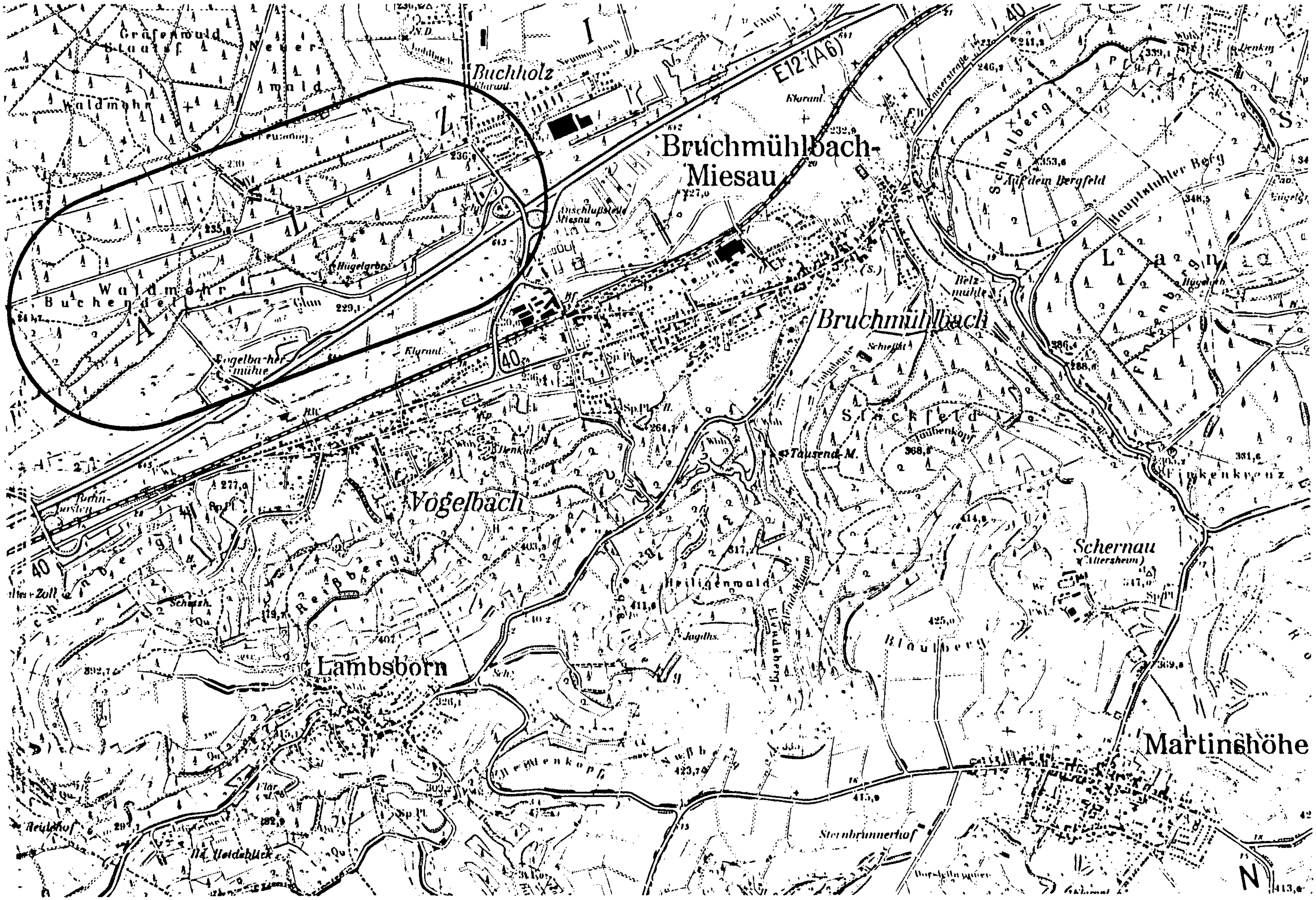
This energy study of Miesau Ammo Depot, Zweibruecken Military Community was authorized by the Department of the Army, Office of the Chief of Engineers as part of an Energy Engineering Analysis (EEA) Program. Overall program management rests with the Huntsville Division Corps of Engineers while contract management was performed by the Europe Division, headquartered in Frankfurt, West Germany.

This study is one of five EEA studies performed concurrently on five military communities, namely: Pirmasens; Zweibruecken; Norddeutschland; Baumholder; and Wiesbaden Military Communities. Miesau Ammo Depot, located near the vicinity of Bruchmühlbach-Miesau, is the only installation surveyed in the Zweibruecken Military Community. The location of Miesau Ammo Depot is shown on the vicinity map in Figure 1.1. The majority of the heated buildings in Miesau Ammo Depot are maintenance facilities, barracks, warehouses and administration type buildings, all of which are OMA funded facilities. Heated buildings number 94 with a total gross square foot area of about 1,203,000. The majority of the buildings are of permanent masonry construction and are, in general, adequate to meet the requirements; however, most buildings are considered in only fair condition requiring more than normal maintenance and repair just to maintain the facilities in usable condition.

Utility systems primarily consist of heating plants and distribution systems, electrical supply and distribution systems, and water and sewage pump stations. In general, these systems were found to be in good condition. Central heating plants and several individual heating plants are required for space heating and domestic hot water. One of the two central heating plants fires bituminous coal and has been equipped with three new boilers. The other central heating plant fires anthracite and has six boilers reported to be in poor condition.

FIGURE I.1

ZWEIBRÜCKEN MILITARY COMMUNITY
MIESAU AMMO DEPOT (GY 036)



1.1 Objective

The objectives of this Energy Study, in accordance with the "Schedule of Title I Services for Energy Engineering Analysis Program, Europe", 13 December 1980, are as follows:

a. Develop a systematic plan of projects that will result in the reduction of energy consumption in compliance with the objectives set forth in the Army Facilities Energy Plan, without decreasing the readiness posture of the Army.

b. Use and incorporate applicable data and results of related studies, past and current as feasible.

c. Develop coordinated basewide energy plans for each military community.

d. Prepare Program Development Brochures (PDB), DD Forms 1391, and supporting documentation for recommended ECIP projects.

e. Include in the program studies all methods of energy conservation which are practical (insofar as the state-of-the-art is reasonably firm) and economically feasible in accordance with guidance given.

f. List and prioritize all recommended energy conservation projects.

The long term objective is to implement a policy of becoming as energy self-sufficient as the state-of-the-art for energy conservation will allow within our resources and economic bounds set by the full implementation of our national energy policy as prescribed by the Army Facilities Energy Plan (dated 1 Oct 1978). See Figure 6.4

The Energy Engineering Analysis (EEA) for Miesau Ammo Depot includes Increments A, B, G and F of Title I Services, defined as follows:

Increment A: Energy Conservation Opportunities(ECO's) which fall under the Energy Conservation Investment Program (ECIP) for buildings and processes.

Increment B: ECIP projects for utilities, energy distribution, Energy Management Control Systems (EMCS) and the use of waste fuels.

Increment G: Operation, maintenance, repair and minor construction projects for energy conservation.

Increment F: Recommendations for modifications of facilities' system operations.

Data was collected on the design and condition of the physical facilities during detailed field surveys of representative buildings. Energy consumption characteristics were defined using information furnished by the community and by field measurement and data collection. A survey program, covering all buildings, was carried out to identify ECO's in the operation and maintenance of the utility systems.

Collected data was analyzed to identify the energy conservation opportunities, which fall into the above work increments, and to predict the savings which could result from repairs and improvements. A major part of the analyses focused on comparing theoretical energy requirements of the buildings with the reported energy consumption. The BLAST computer program was used to compute heat loads for buildings,

while a custom program was developed to combine the effects of energy conversion and distribution efficiency with the theoretical heat loads and known fuel consumptions. The latter program produced the fuel distribution report for each major heating system and characterized the loads.

The energy consumption characteristics of Miesau Ammo Depot are typical of the installations throughout West Germany which provide a complete working and living environment for military personnel. In contrast to many military facilities in the United States, their is no air conditioning for comfort cooling. Energy loads can be broadly classified into several groups as follows:

Thermal

- space heating
- domestic hot water
- process

Electrical

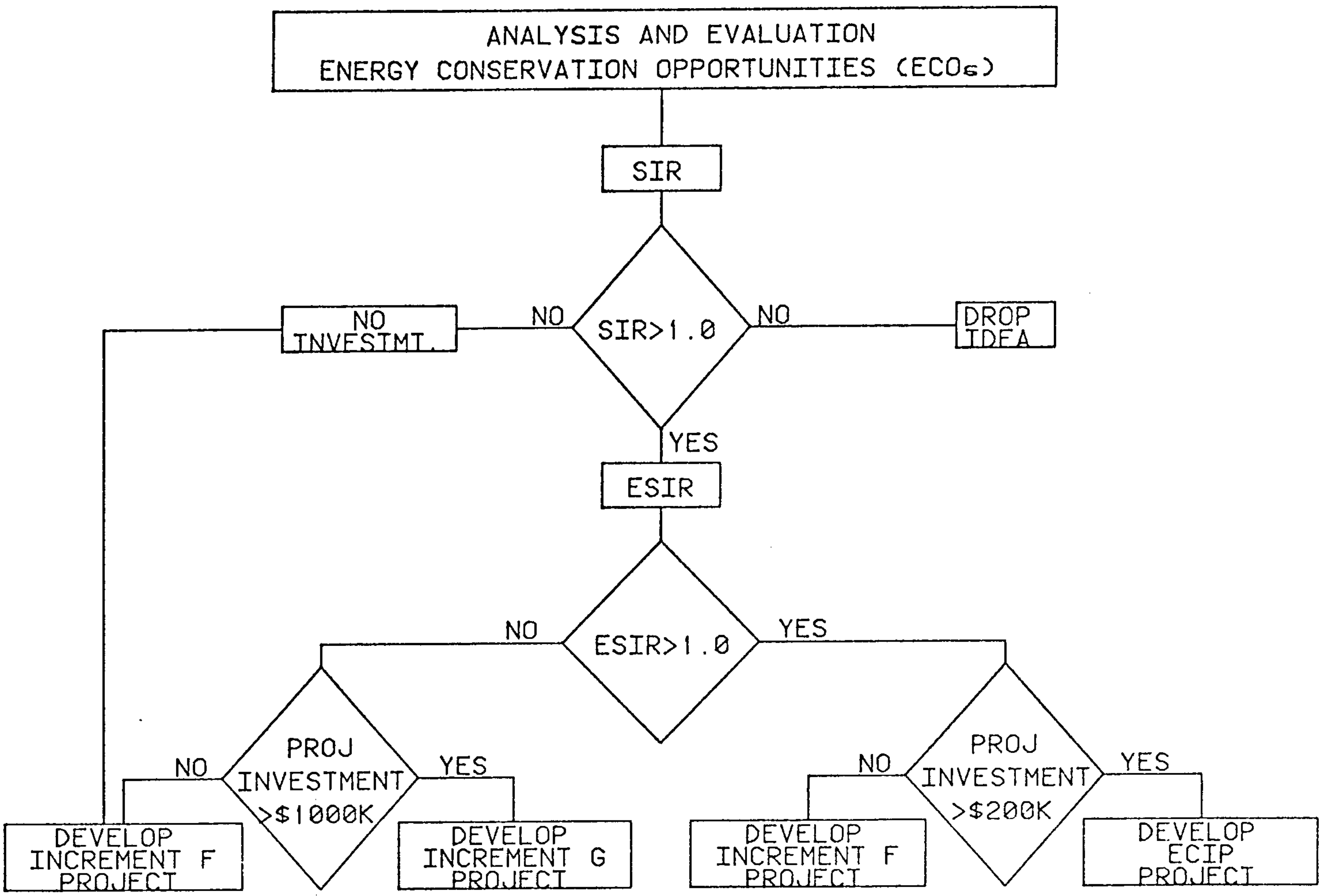
- lighting
- domestic appliances
- clothes dryers
- utility system motors
- shop and store equipment

Thermal and electrical loads at the studied installations peak in mid-winter and are lowest in mid-summer, as expected. Electrical loads peak during normal work day hours and follow typical patterns for a commercial type community in a Northern climate. Weekend electrical load peaks are much smaller than weekday peaks, indicating that work areas are effectively shut down on weekends.

Based on the physical facilities and the energy load characteristics, ECO's were developed and analyzed for feasibility in accordance with FY 85 ECIP Guidance. Figure 1.2 shows the Project Flow Diagram indicating the economic analysis of an ECO. A systematic approach considering primary energy conversion, energy distribution, and energy utilization was employed to assure that the opportunities for energy savings would be identified. Special attention was given to state-of-the-art energy technology for conservation, management, and alternatives to the use of fossil fuels.

In cooperation with the Community, the A/E developed ECIP programming packages based upon study recommendations. DD Forms 1391 were prepared and submitted to the Community on 9 June 1983 for approval.

Detailed field survey data which served as the basis of the energy engineering analysis was previously submitted to the Zweibruecken Community in a series of data report volumes. The contents of the interim submission, Volume I and II for increments A, B, and G, and the contents of the preliminary submission for increment F are combined and updated in this report.



NOTES: 1. SAVINGS TO INVESTMENT RATIO (SIR) CALCULATED AS PER NEW ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) GUIDANCE.

2. CALCULATE ENERGY SAVINGS TO INVESTMENT RATIO (ESIR) USING THE LOWER NUMBER:
(ENERGY $ SAVINGS + 0.33 ENERGY $ SAVINGS)/INVEST
(ENERGY $ SAVINGS + 0.33 ENERGY $ SAVINGS)/INVEST

2.0 EXISTING ENERGY CONSUMPTION

Energy consumption in FY 1975 is the baseline against which the reduction of energy consumption is measured. FY 1980 energy consumption data was used as a reference year for the EEA study. Energy consumption data for Miesau Ammo Depot for both these years is shown in Table 2.1. This data was provided by the installation and includes the same energy consumers as the EEA study.

To characterize the fuel consumption of Miesau Ammo Depot, data for three fiscal years is compared in Figure 2.2. Figure 2.3 through 2.5 show the consumption profiles for individual fuels for FY 78, FY 79 and FY 80. Figure 2.6 shows the total electrical consumption of Miesau Ammo Depot; this is broken down to on-peak consumption and off-peak consumption relating to the utility's time-of-day rates. On-peak consumption ranges from approximately 220,000 kWh to 580,000 kWh per month and off-peak ranges from approximately 250,000 kWh to 450,000 kWh per month. Figure 2.7 shows the demand profile for Miesau Ammo Depot. Figure 2.8 shows the proportion of energy consumed by type of load.

The BLAST program was used to characterize the energy consumption of individual buildings. Annual fuel consumption profiles for specific buildings with typical functions and design day load profiles for representative types of buildings in Miesau Ammo Depot are presented in Section 3, Volume II: Figures 2.9 and 2.10 are typical. The building type indicated on the design day load profile is the classification used in the Fuel Distribution Program (FDP) previously mentioned. Estimated distribution of the fuel consumption by building and load type is shown in Figures 2.11 through 2.14.

TABLE 2.1

BASELINE AND REFERENCE ENERGY CONSUMPTION DATA

(Based on 1.203×10^6 SF Area)

	FY 1975	FY 1980	
Fuel Type	Consumption (MBTU/yr)*	$/MBTU	Consumption (MBTU/yr)*
Anthracite Coal	50,292	3.78	21,720
Bituminous Coal		2.95	17,592
Heating Oil No. 2	84,790	7.51	52,371
Heating Oil No. 6	7,223	5.53	5,942
Electric**	84,860	4.81	106,310
TOTAL (MBTU)	227,165		203,935
KBTU/sq.ft./yr	188.8		169.5

*MBTU = 10E6 BTU

**11,600 BTU/kWh

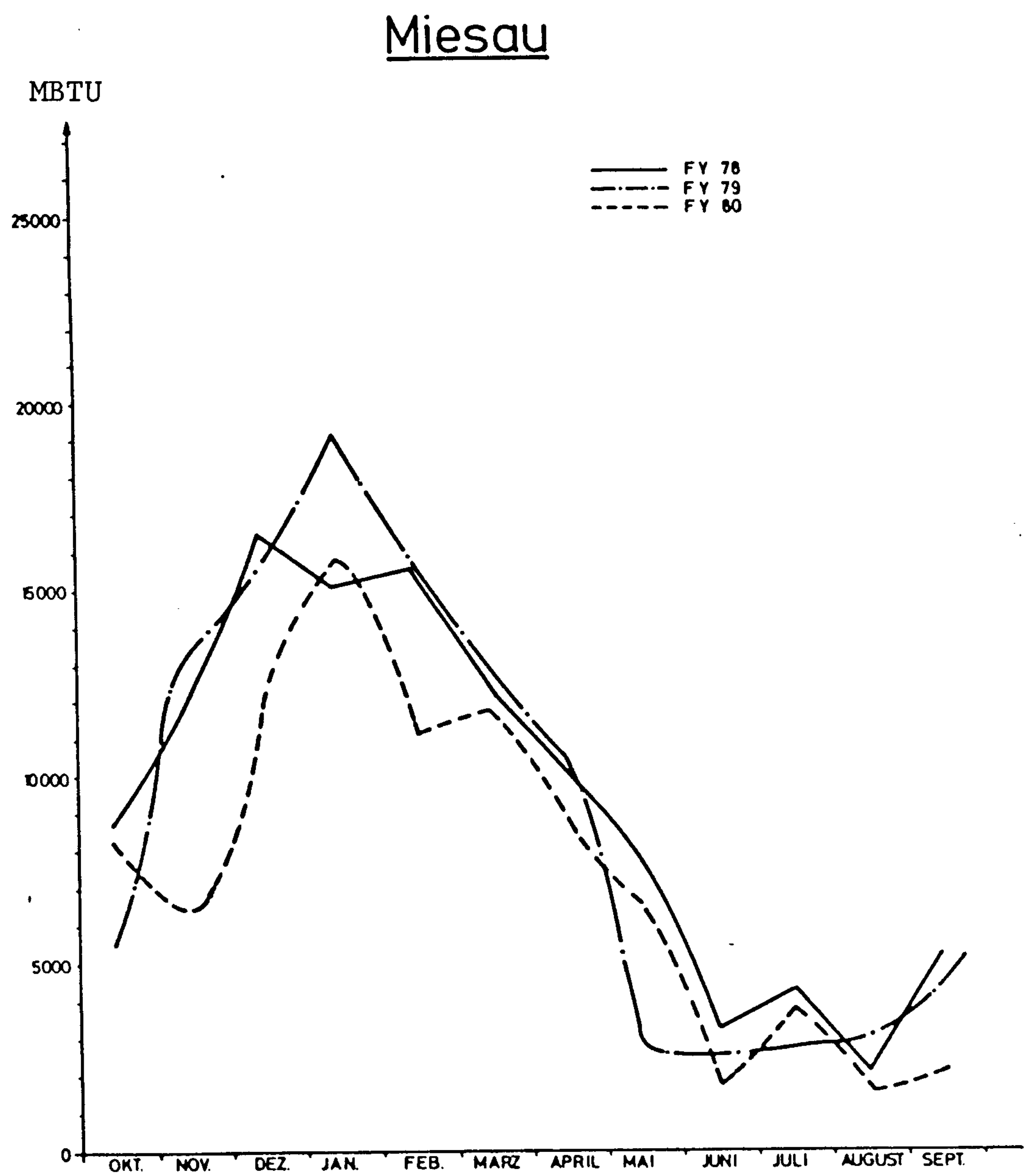


Figure 2.2 : Annual Fuel Consumption Curve (FY 1978, 79, 80) for Miesau Ammo Depot, Zweibrucken Military Community

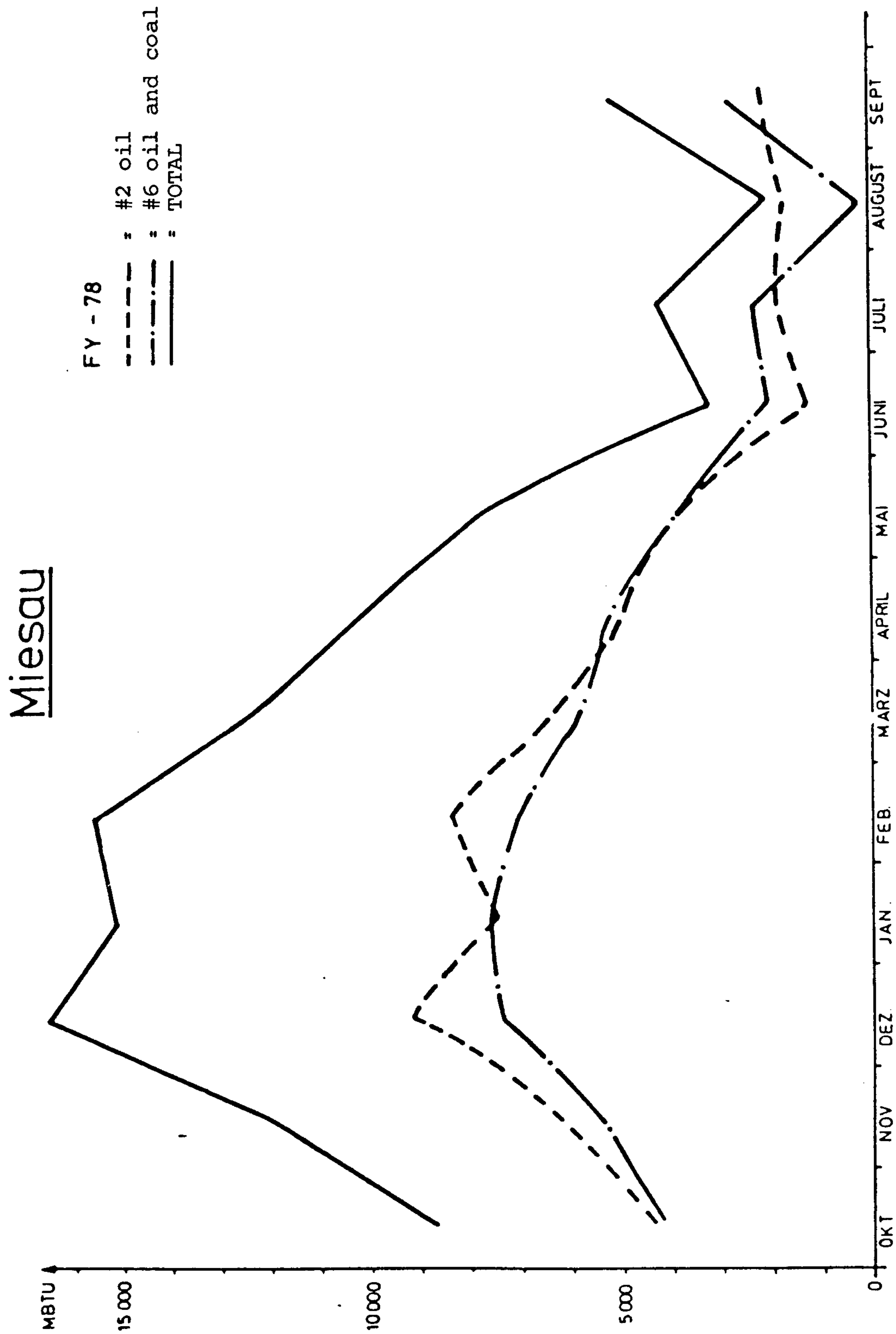


Figure 2.3 : FY78 Annual Fuel Consumption Curve for Miesau Ammo Depot

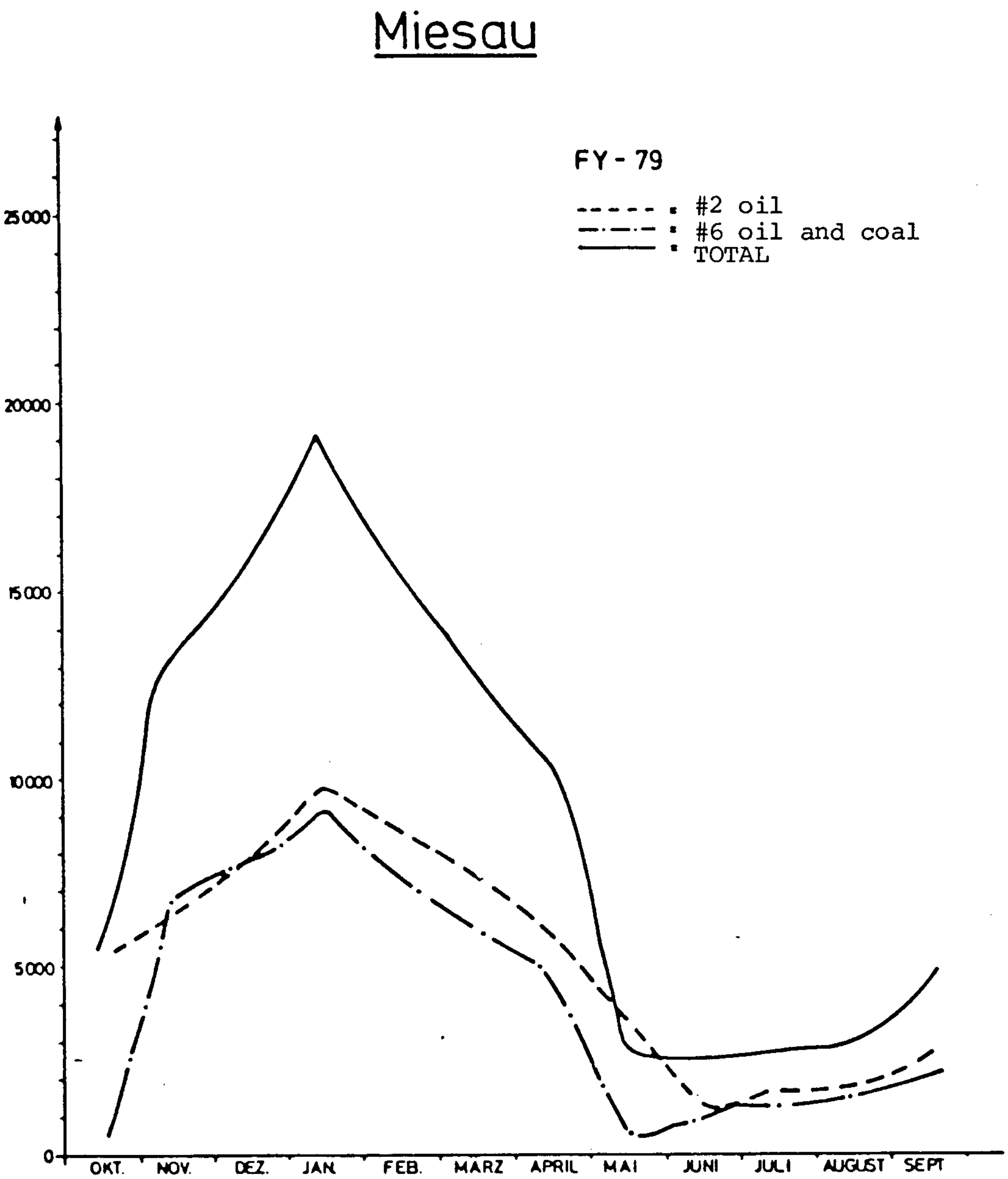


Figure 2.4 : FY79 Annual Fuel Consumption Curve for Miesau Ammo Depot

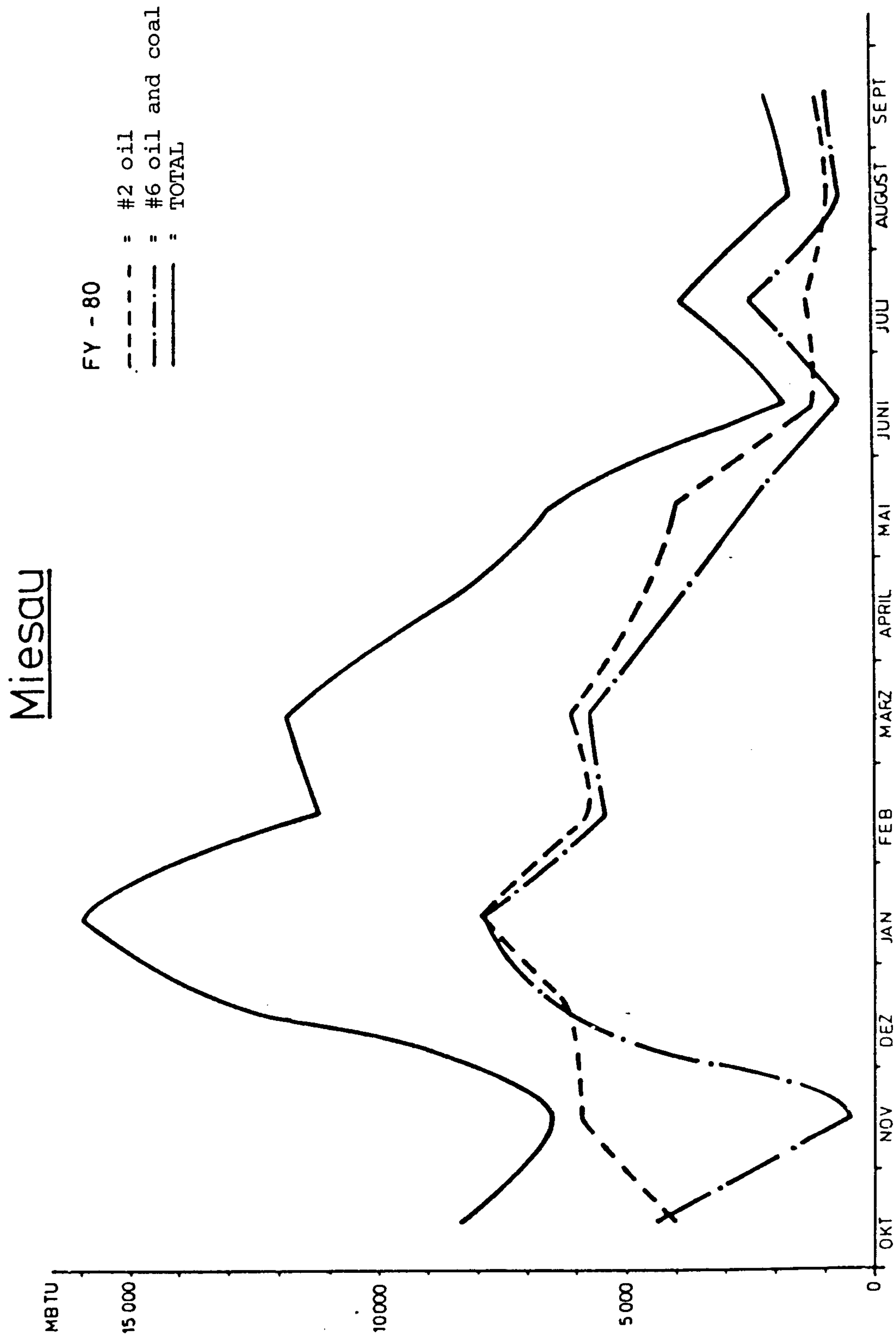


Figure 2.5 : FY80 Annual Fuel Consumption Curve for Miesau Ammo Depot

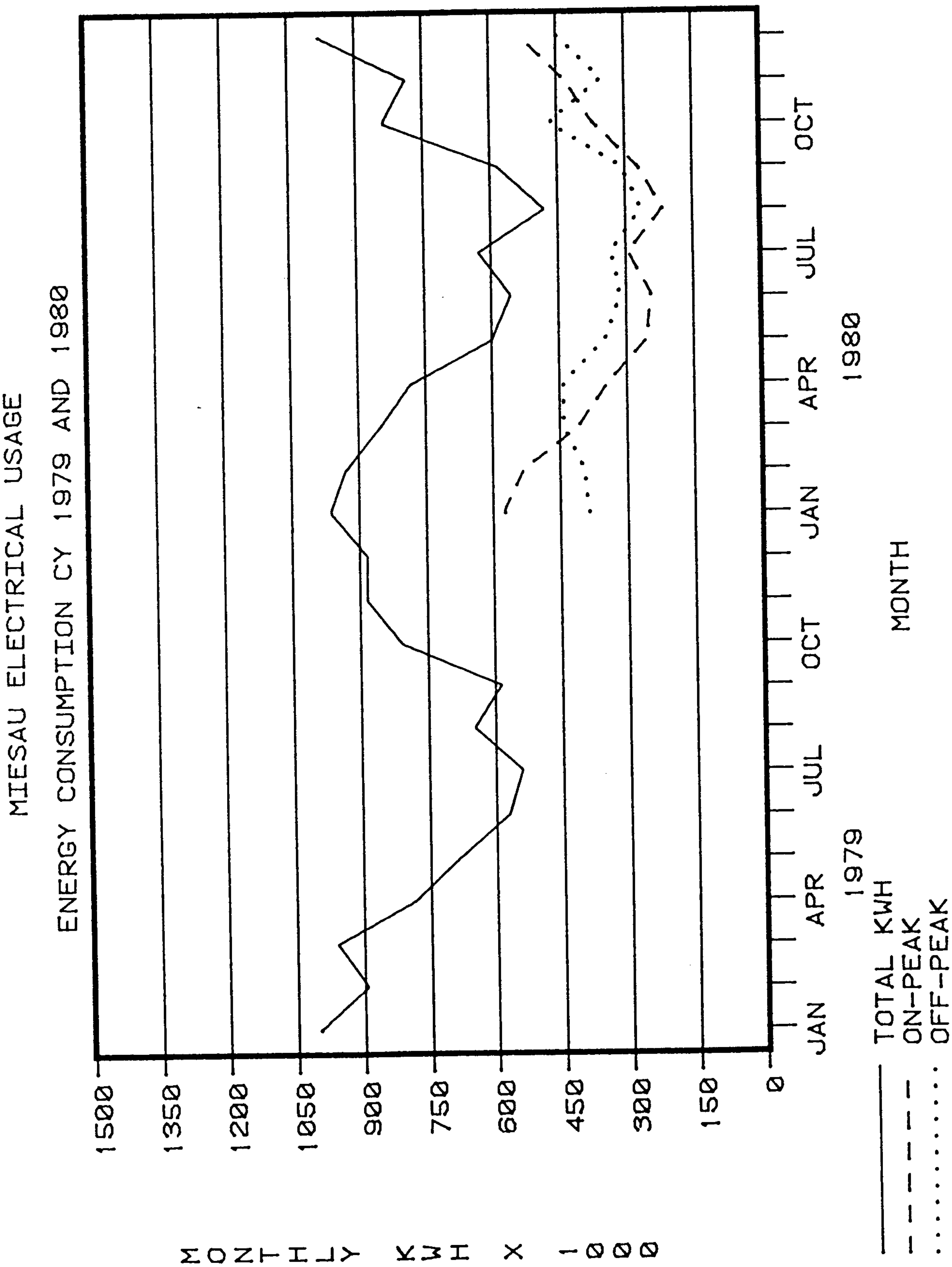

MIESAU ELECTRICAL USAGE
ENERGY CONSUMPTION CY 1979 AND 1980
MONTHLY KWH X 1000
1500
1350
1200
1050
900
750
600
450
300
150
0
JAN
APR
JUL
OCT
JAN
APR
JUL
OCT
1979
1980
MONTH
TOTAL KWH
ON-PEAK
OFF-PEAK

FIGURE 2.6

DEMAND PROFILE

MIESAU - CY 1980 AND 1981(PARTIAL)

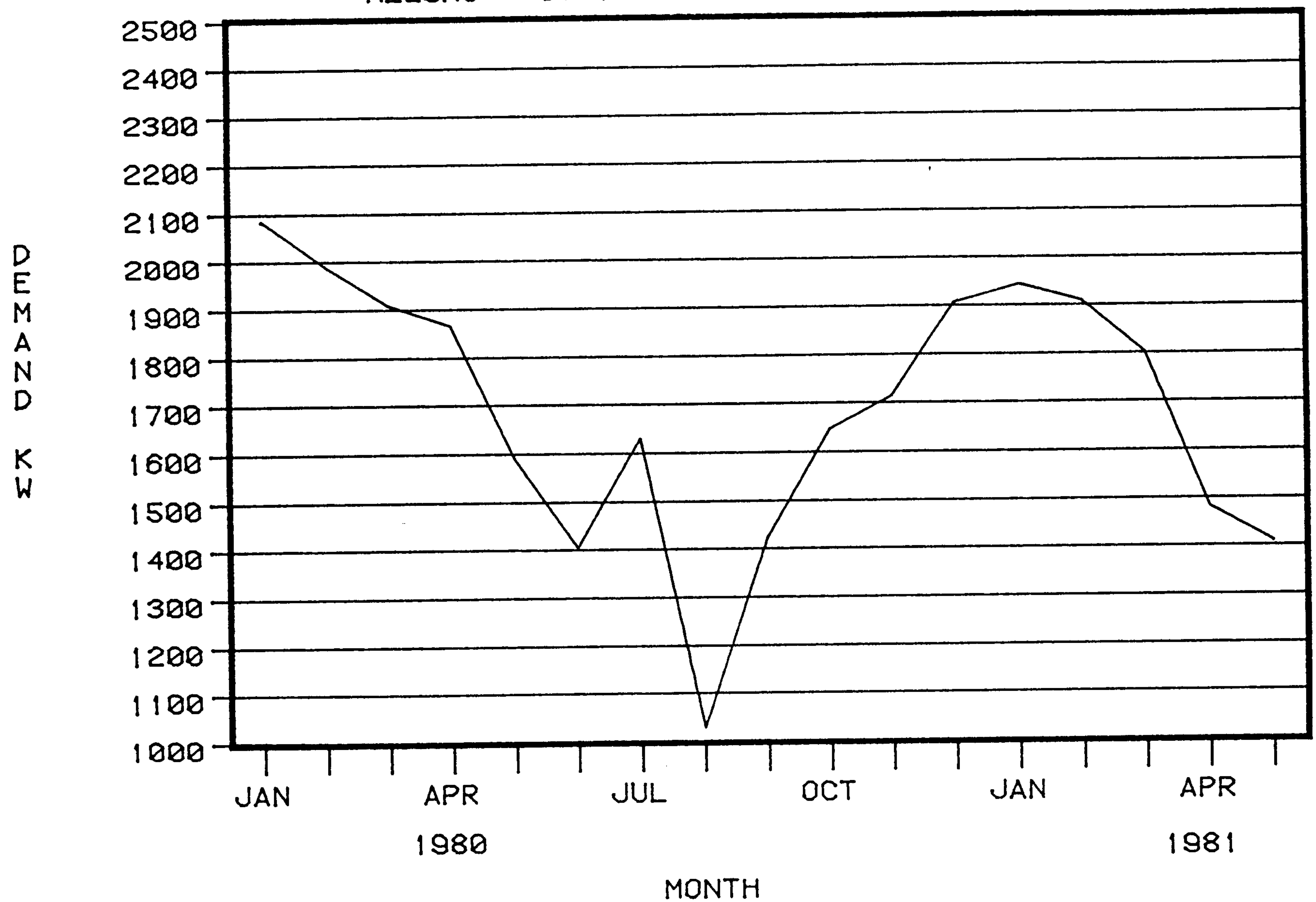
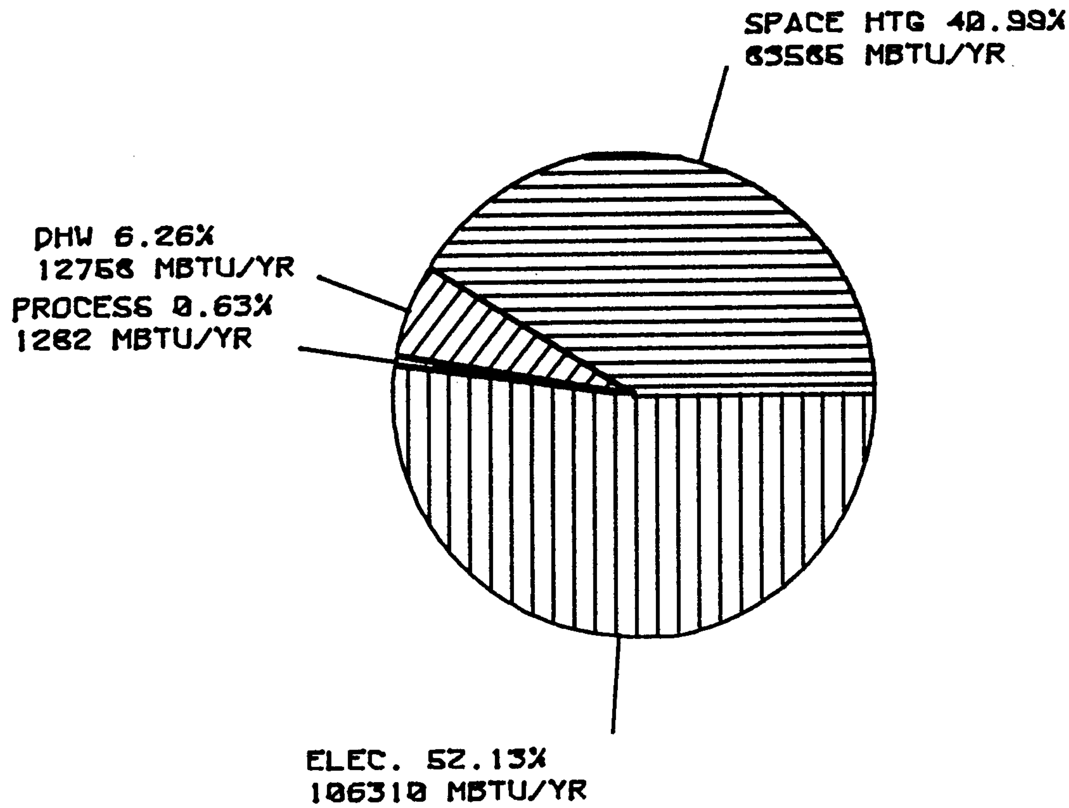


FIGURE 2.7

FIGURE 2.6

MIESAU AMMO DEPOT

TOTAL ENERGY CONSUMPTION (FY 1980)



TOT. ENERGY CONSUMPTION - 203,955 MBTU/YR (52,942 MBTU/YR #2 OIL; 6,942 MBTU/YR #6 OIL; 39,312 MBTU/YR COAL; 106,310 MBTU/YR ELEC.)

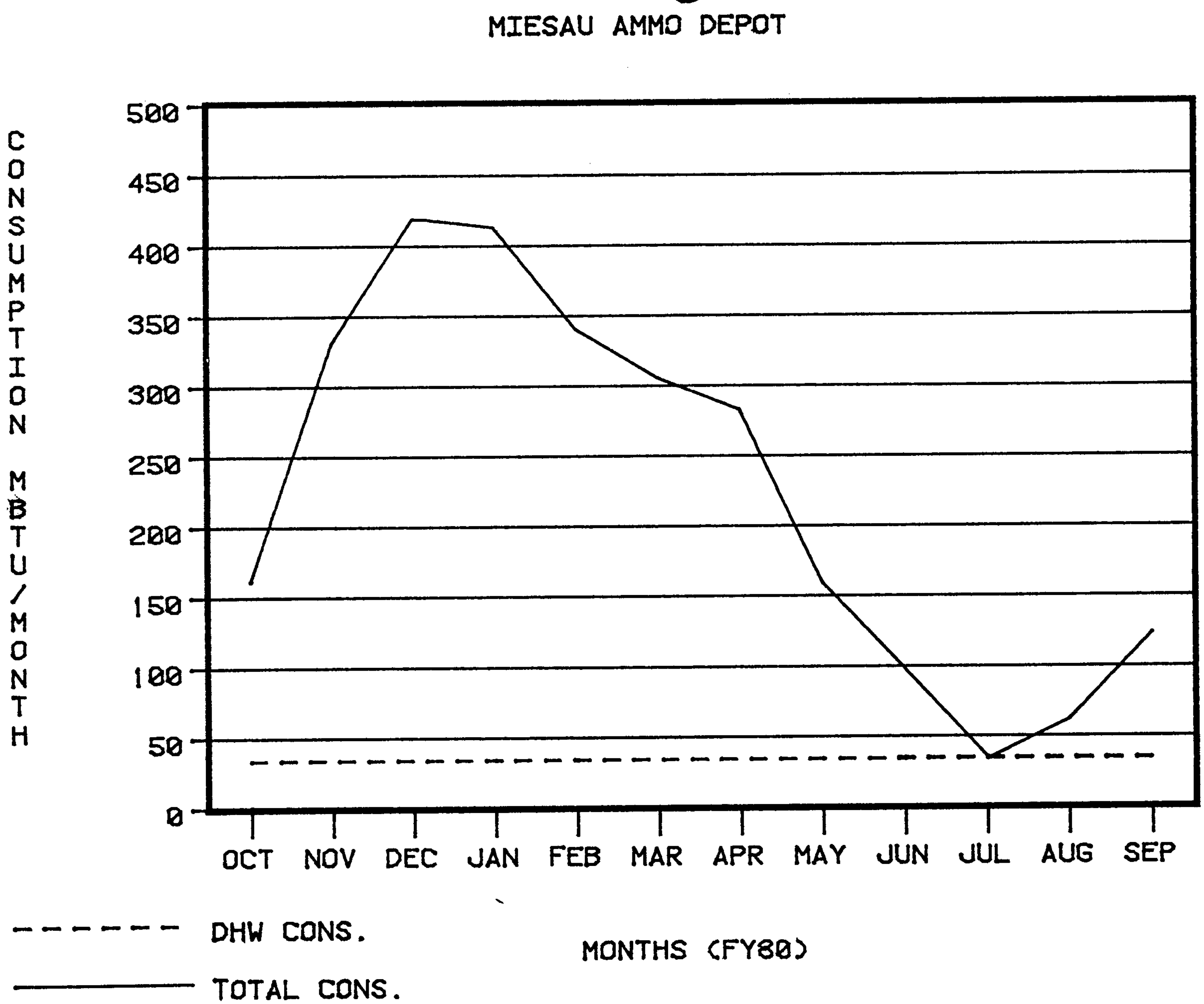
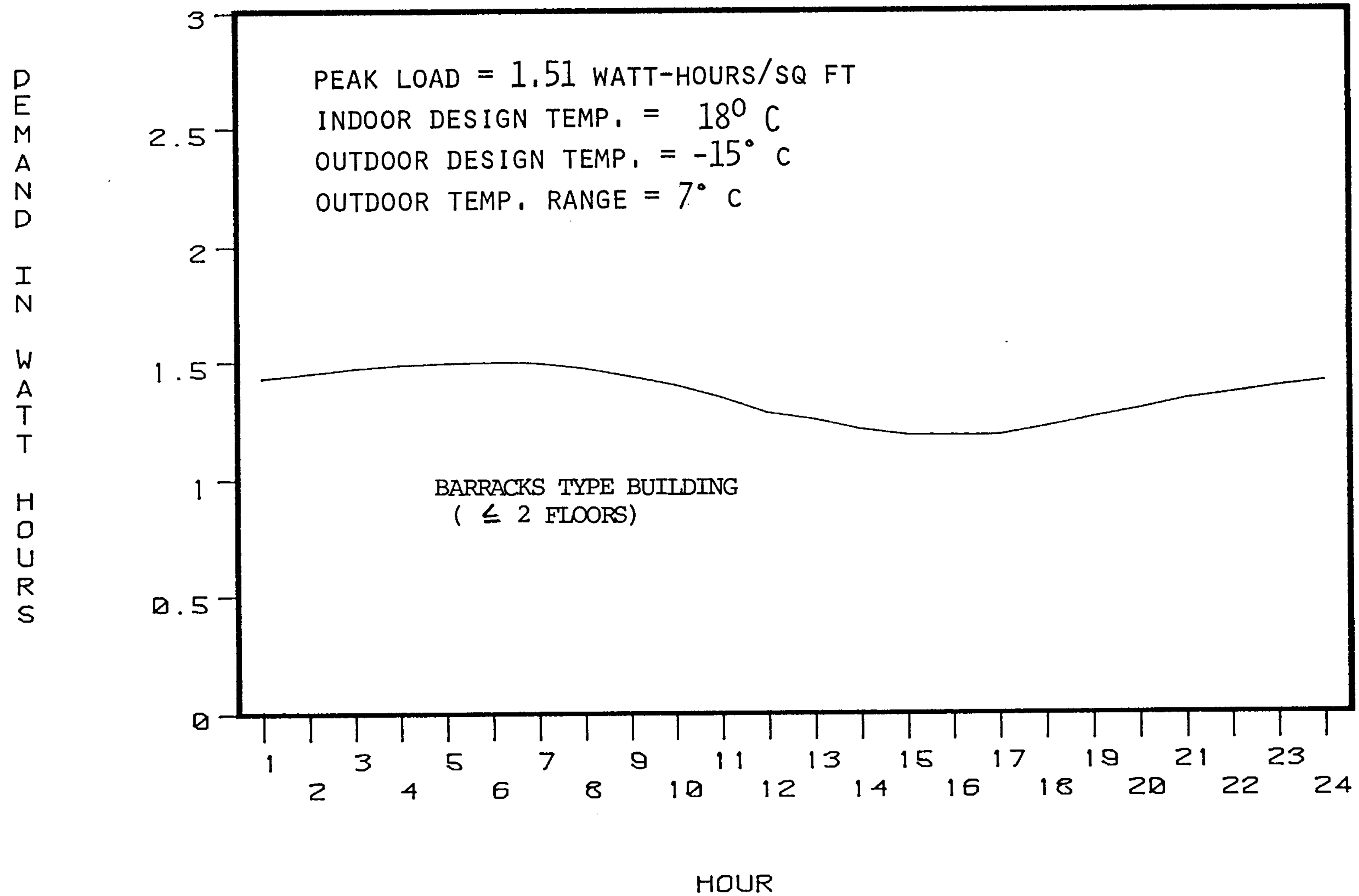


FIGURE 2.9: Annual Fuel Consumption Profile for Building 1220 - Gymnasium

MIESAU AMMO DEPOT

BLDG TYPE 3: DAILY LOAD PROFILE FOR DESIGN DAY *



* LOAD PROFILE CALCULATED BY "BLAST"

FIGURE 2.10

BLAST WEIGHTING FACTORS 13-APR-83 14:28:42

ZWEIBRUCKEN MILITARY COMMUNITY

FUEL DISTRIBUTION

UNITS: AREA = SQUARE FEET, FUEL CONSUMPTION = MBTU/YR, LOAD = MBTU/YR

HEAT PLNT	BLDG SERV	BLDG FUNC	BLDG TYPE	TOTAL AREA	NET AREA	HEAT SYST	FUEL TYPE	FUEL CONS	EFF	SPEC LOAD	DHW LOAD	SPACE LOAD
1204												
	1204	ADMNSTRTN	5	6106	4123	LTW	OIL2	637	0.81	0	0	316
1206												
	1206	BRCKS/MESS	4	45135	38382	LPS	OIL2	9247	0.72	630	2230	3778
	1311	CAFETERIA	8	4235	3946	LPS	OIL2	1351	0.63	0	234	617
1210												
	1210	BRCKS/ADMIN	4	43963	37368	LPS	OIL2	6165	0.81	0	1648	3145
1216												
	1216	ADMNSTRTN	6	24970	22470	LPS	OIL2	1708	0.80	0	82	1284
1220												
	1220	GYMNASIUM	8	16419	14552	LPS	OIL2	2707	0.72 ×	0	195	1754
	1222	SCHOOL	8	3793	2678	LPS	OIL2	497	0.65 ✓	0	0	323
1227												
	1227	SWG TRTMNT	9	81	64	AIR	ELEC	11	1.00	0	0	11
1237												
	1237	RPR SHP/AD	12	19686	11287	LTW	OIL2	3097	0.79	0	73	2373
1251												
	1251	MAINT/WRHS	11	13770	11800	LTW	OIL2	956	0.71	0	0	679
1252												
	1252	WAREHOUSE	11	13613	11787	LPS	OIL2	958	0.80	0	0	766
1256												
	1256	WAREHOUSE	11	2670	2592	LTW	OIL2	754	0.71	0	0	535
1259												
	1259	MAINT SHOP	11	7763	7346	LTW	OIL2	1337	0.81	0	0	1083
1274												
	1274	WAREHOUSE	12	10141	9841	AIR	ELEC	150	1.00	0	0	150
1275												
	1275	WAREHOUSE	12	10141	9841	AIR	ELEC	150	1.00	0	0	150
1276												
	1276	WAREHOUSE	12	10141	9841	AIR	ELEC	150	1.00	0	0	150
1300												
	1300	THEATRE	8	7258	6301	LPS	OIL2	697	0.80	0	0	558

FIGURE 2.11

1301												
	1301	BOWL CNTR	8	3998	3531	LTW	OIL2	652	0.78	0	0	509
1304												
	1304	NCO CLUB	10	7630	6604	LTW	OIL2	1854	0.82	0	547	973
1340												
	1340	ADMNSTRTN	5	4659	3523	LTW	OIL2	727	0.71	0	26	490
1361												
	1361	ADMNSTRTN	8	7512	5509	LTW	OIL2	974	0.74	0	0	721
1364												
	1364	WTR TRTMNT	11	4667	4489	AIR	ELEC	430	1.00	0	0	430
1370												
	1320	STORAGE	12	1685	1638	LTW	BIT	509	0.67	0	10	331
	1321	PO MAIN	8	1685	1610	LTW	BIT	309	0.67	0	21	186
	1325	BARRACKS	3	6163	4807	LTW	BIT	1109	0.67	0	290	453
	1326	BARRACKS	3	6163	4807	LTW	BIT	1109	0.67	0	290	453
	1327	BARRACKS	3	6163	4807	LTW	BIT	1109	0.67	0	290	453
	1328	ADMNSTRTN	8	4659	3523	LTW	BIT	676	0.67	0	45	408
	1330	BARRACKS	3	6163	4807	LTW	BIT	1109	0.67	0	290	453
	1331	BARRACKS	3	6163	4807	LTW	BIT	1109	0.67	0	290	453
	1332	BARRACKS	3	6163	4807	LTW	BIT	1109	0.67	0	290	453
	1333	ADMNSTRTN	5	4659	3523	LTW	BIT	1007	0.67	0	34	641
	1338	BARRACKS	3	6163	4807	LTW	BIT	1109	0.67	0	290	453
	1339	BARRACKS	3	6163	4807	LTW	BIT	1109	0.67	0	290	453
	1343	BARRACKS	3	6163	4807	LTW	BIT	1109	0.67	0	290	453
	1344	BARRACKS	3	6163	4807	LTW	BIT	1109	0.67	0	290	453
	1345	ADMNSTRTN	5	4740	3523	LTW	BIT	1007	0.67	0	34	641
	1348	BRCKS/ADMIN	3	6134	4807	LTW	BIT	1109	0.67	0	290	453
	1366	MESSHALL	10	5794	4519	LPS	BIT	1963	0.67	273	460	582
	1370	CNTRL HEAT	14	4220	4009	N/A	BIT	0	0.72	0	0	0
	1375	CMNTY CNTR	8	3400	2890	LTW	BIT	554	0.67	0	37	334
1376												
	1376	REPAIR SHOP	11	35224	34143	LTW	OIL2	4928	0.79	0	0	3893
1400												
	1400	WTNG SHLTR	8	2528	2108	AIR	OIL2	446	0.80	0	36	321
1414												
	1414	WAREHOUSE	11	4119	3498	AIR	OIL2	1017	0.80	0	0	814
1429												
	1429	WAREHOUSE	12	38731	33407	LTW	OIL2	3598	0.78	0	84	2722
1437												
	1437	METAL SHOP	11	5337	5052	AIR	ELEC	140	1.00	0	0	140
1440												
	1440	ADMNSTRTN	5	2938	2665	LTW	OIL2	550	0.71	0	0	391
1445												
	1445	REPAIR SHOP	11	10359	8907	AIR	OIL2	2590	0.80	0	0	2072

FIGURE 2.12

1447												
	1447	FIRE STN	5	6235	4988	LPS	OIL2	954	0.72	0	34	653
1537												
	1510	AMMO SHOP	11	11328	10303	LPS	ANTH	4046	0.44	0	0	1760
	1517	AMMO SHOP	11	5337	5052	LPS	ANTH	1954	0.44	0	0	873
	1518	TOOL ROOM	11	2522	2500	LPS	ANTH	982	0.44	0	0	432
	1533	SHELTER	8	1832	1612	LPS	ANTH	575	0.44	0	25	228
	1534	LUNCHROOM	7	2212	1725	LPS	ANTH	739	0.44	0	81	244
	1537	CNTRL HEAT	14	1774	1419	N/A	ANTH	0	0.58	0	0	0
	1540	AMMO SHOP	11	5261	4954	LPS	ANTH	1946	0.44	0	0	856
	1545	STR MHE	11	1760	1584	LPS	ANTH	622	0.44	0	0	274
	1546	STOREHOUSE	11	1760	1584	LPS	ANTH	622	0.44	0	0	274
	1547	STOREHOUSE	11	2241	2129	LPS	ANTH	836	0.44	0	0	368
	1552	AMMO SHOP	11	13803	12671	LPS	ANTH	4976	0.44	0	0	2190
	1553	AMMO SHOP	11	11328	9629	LPS	ANTH	3782	0.44	0	0	1664
	1557	AMMO SHOP	11	3796	3546	LPS	ANTH	1393	0.44	0	0	613
1593												
	1592	AMMO SHOP	11	16987	14439	HPS	OIL6	6337	0.68	0	0	4309
	1593	CNTRL HEAT	14	1496	1197	N/A	OIL6	0	0.78	0	0	0
1612												
	1612	OPERATIONS	5	2238	1790	LTW	OIL2	369	0.71	0	13	249
1626												
	1625	MAINT SHOP	11	22653	20476	LPS	OIL2	5598	0.68	0	0	3807
	1626	CNTRL HEAT	14	3285	2972	N/A	OIL2	0	0.77	0	0	0
	1630	MSSL MAINT	11	3498	2973	LPS	OIL2	813	0.68	0	0	553
1627												
	1627	READY BLDG	5	8395	6716	LTW	OIL2	867	0.71	0	31	585
1632												
	1632	OFFICE	5	570	450	LTW	OIL2	124	0.71	0	4	84
1633												
	1633	DOG KENNEL	5	5044	4035	LTW	OIL2	1115	0.71	0	40	752
1634												
	1634	SHELTER	5	2528	2108	AIR	OIL2	112	0.80	0	4	85
1682												
	1682	ADMNSTRTN	5	5016	4285	AIR	OIL2	884	0.80	0	0	708
1684												
	1684	ADMNSTRTN	5	5016	4285	AIR	OIL2	884	0.80	0	0	708

UNHEATED BUILDINGS

BUILDING NUMBER	BUILDING FUNCTION
1270	HUMIDITY CONTROLLED WAREHOUSE
1271	HUMIDITY CONTROLLED WAREHOUSE

FIGURE 2.13

1272	HUMIDITY CONTROLLED WAREHOUSE
1384	HUMIDITY CONTROLLED WAREHOUSE
1385	HUMIDITY CONTROLLED WAREHOUSE
1386	HUMIDITY CONTROLLED WAREHOUSE
1401	HUMIDITY CONTROLLED WAREHOUSE
1402	HUMIDITY CONTROLLED WAREHOUSE
1403	HUMIDITY CONTROLLED WAREHOUSE
1404	HUMIDITY CONTROLLED WAREHOUSE
1410	OPEN WAREHOUSE
1411	OPEN WAREHOUSE
1415	OPEN WAREHOUSE
1418	OPEN WAREHOUSE
1421	OPEN WAREHOUSE
1422	OPEN WAREHOUSE
1424	SEWAGE PUMP STATION
1426	HUMIDITY CONTROLLED WAREHOUSE
1427	HUMIDITY CONTROLLED WAREHOUSE
1428	HUMIDITY CONTROLLED WAREHOUSE
1450	OPEN WAREHOUSE
1452	OPEN WAREHOUSE
1454	OPEN WAREHOUSE
1458	OPEN WAREHOUSE
1516	AMMO SHOP UNDER RENOVATION
1555	COMPRESSED AIR PLANT
1594	SEWAGE TREATMENT PLANT
1614	CENTRAL HEATING PLANT
1655	WATER TREATMENT PLANT

FIGURE 2.14

3.0 ENERGY CONSERVATION OPPORTUNITIES DEVELOPED

As described under the Methodology Section, Volume II: Study Report, based upon record data provided by the community, detailed site surveys and discussions with Facilities Engineering personnel, all practical energy conservation measures were technically and economically evaluated to determine if they met ECIP criteria. The "Energy Conservation Options" listing for Climate Zone 3 (3000 - 6000 degree days) in Annex E of the Army Facilities Energy Plan was used as a starting list of possible conservation measures; this list, modified to be applicable to installations in West Germany, is presented in Section 4, Volume IV: Appendix. Recommended modifications which were not on the list include the installation of fans to prevent hot air stratification, installation of thermal barriers for windows in intermittently occupied buildings, installation of domestic hot water heat pumps and installation of turbulators in firetube boilers.

Based upon recommendations made by the A/E in the Interim Submittal and agreements reached with the community, recommended ECIP projects were packaged and project documents developed for ECIP funding in accordance with FY 85 criteria. Those energy conservation measures are described hereafter; ECO numbers and titles correspond to those presented in Section 4 of Volume II.

ECO No. 41111: Weatherstripping

Infiltration of outside cold air through openings and gaps in the building shell can account for up to 25% of the total annual space heating fuel consumption. Weatherstripping is a cost effective way of significantly reducing infiltration through windows and doors which currently have no weatherstripping.

ECO No. 41112: Vestibule

By constructing a new exterior door and passageway in front of an existing exterior door the infiltration of outside air into a building is significantly reduced. Vestibules are cost effective at door locations which are frequently used.

ECO No. 41121: Roof Insulation

Heat load analysis leads to the recommendation of roof insulation for many buildings. Building roofs generally have higher heat loss and lower insulation cost per square foot than walls. The best type of insulation is determined by the configuration and the utilization of the attic space.

ECO No. 41141: Double Glazed Windows

A significant portion of energy loss through a building envelope is due to windows. Heat Losses occur due to both conduction of heat through the glass and infiltration of outside air through window perimeter cracks. Where infiltration heat losses are excessive due to poor fitting windows, new double glazed tight fitting windows are recommended. Although weatherstripping can also reduce infiltration through windows, the life of the weatherstripping is very limited compared to carefully installed windows.

ECO No. 41142: Thermal Barrier for Windows

Many industrial, administrative, religious and recreational buildings are unoccupied for more hours per week than they are occupied. The addition of a thermal barrier can reduce large conduction losses during unoccupied periods making it economically attractive for certain buildings.

ECO No. 41211: Lighting System Replacement

The development of high efficiency lighting systems created opportunities for reducing the energy for lighting without reducing the illumination. In many lighting systems this can be accomplished by simply replacing the lamp. Slight modifications to existing fixtures are required for some conversions to high efficiency lamps.

ECO No. 42111: Thermostatic Radiator Valves

Thermostatic radiator valves regulate indoor temperature by controlling the heating fluid supply to radiators. Thermostatic radiator valves reduce localized overheating by compensating for interior and exterior heat gains other than the heating system and limit the maximum heat supply to a radiator.

ECO No. 42113: Building LPS Controls

Building heating system controls are installed to regulate the steam supply to the building terminal units in response to outdoor temperature. Overheating of buildings is thus reduced and steam pressure may be lowered to reduce distribution losses.

ECO No. 42121: Prevent Air Stratification

In large open areas with high ceilings, warm air rises creating a temperature differential between the floor and ceiling. If room air is vertically mixed, such as by ceiling fans, the air temperature stratification is reduced. A more uniform temperature results in less heat to maintain minimum temperature at the occupied floor level and less heat loss through the roof.

ECO No. 43111: Install Flue Gas Dampers

Burners in small oil and gas fired boilers are typically controlled by on-off or stepped firing rates. Natural draft of the flue gas exhaust continues to draw air through the boiler during burner shutoff resulting in the exhaust of heated air. Automatic dampers installed in the flue gas duct close when the burners are off, thereby eliminating unnecessary heat losses through the stack.

ECO No. 43121: Install Heat Pump to Supplement DHW Generation

Small, electric heat pumps, of 750 watts or more, can be tied into existing hot water generation equipment in order to supply a portion of the total energy requirements. This can either be purchased as one complete unit for new installations, or can be added to an existing system.

ECO No. 43131: Install Turbulators in Firetube Boilers

Overall efficiency of firetube boilers can be improved by the installation of turbulators in the steam generating tubes. Turbulators are deformed strips of steel which are inserted directly into the boiler firetubes to improve heat transfer by increasing the turbulence while reducing the velocity of gasses passing through the tubes. Turbulators can be installed with only minor adjustments to the burners and boiler controls.

ECO No. 43132: Install Boiler Combustion Controls

Where annual plant loading is sufficient and the plant efficiency is low, an O_2 trim system which monitors unburned combustilbles can be justified. This type of control will optimize combustion regardless of boiler type, operators experience or even fuel type.

Specific Operations and Maintenance Modifications were identified as follows:

- o Load Shedding
- o Repair Vent Dampers and Seal Miscellaneous Openings in Building Envelopes
- o Reset Existing Heating System Controls and Thermostatic Valves
- o Insulate Valves in Heating Plant
- o Reduce Domestic Hot Water Temperature
- o Repair of Leaks in the Hot Water and Steam Distribution Systems
- o Insulate Hot Pipelines
- o Reduce Heating in Unoccupied Areas
- o Installation of Timers on Vending Machines
- o Reduction of Lighting by Lamp Removal
- o Install Additional Light Switches
- o Add Timers to Light Switches
- o Add Outdoor Light Controls

General Operations and Maintenance Recommendations were made as follows:

- o Night Temperature Setback
- o Domestic Hot Water Flow Control
- o Optimize Transformer Loading

In addition to the above listed projects, developed to improve the efficiency of energy conversion, distribution and utilization, policy changes are recommended which can reduce energy consumption and/or operating costs:

- Improve communications between the users and the office of the facility engineer by means of an "energy conservation coordinator" of each installation and a monitor for each energy consuming building. The energy usage for each building should be recorded and discussed at regular meetings where policy for energy conservation performance can be evaluated.

OK, if approached properly. However, [illegible] create "position" A $30,000/yr that is nothing more than a "light switch turner-offer".

- Educate the building occupants to minimize the use of lighting, domestic hot water and heat. All family housing lighting and some hot water heaters in individual dwelling units are controlled by building occupants. Although building controls and thermostatic valves can reduce overheating, windows and doors left open in the heating season cannot be eliminated by controls.

- Negotiate for reducing the cost of purchased electricity. Since utility rates are designed for an entire class of customers, a fair but more attractive rate may be considered negotiable for a specific load profile. Investigate the consolidation of electrical services which are billed under different rate schedules to achieve a more favorable rate structure.

- Institute procedures to assure that energy savings are considered in all new projects which are specified. When specific goals and guidelines are adopted, the facilities should be upgraded in a uniform manner with each repair or new construction project. All projects should be reviewed by the community energy coordinator to assure that these projects are consistent with energy plan goals.

- Specify energy conservation options for replacement equipment as follows:

  - high efficiency motors
  - high efficiency air conditioning units
  - automatic shut off controls for clothes dryers
  - improved insulation and other design features for domestic food refrigerators

4.0 ENERGY AND COST SAVINGS

Basewide energy consumption after implementation of the EEAP Energy Plan is projected to be 158,594 MBTU/yr; this is a 30% reduction in fuel consumption as compared to FY 75 energy consumption of 227,165 MBTU/yr.

The projected savings are allocated by fuel type as follows:

		ANNUAL CONSUMPTION (MBTU/yr)			SAVINGS
		FY 75	FY 80	FY 86	MBTU/YR
Electric	:	84,860	106,310	100,155	-15,295
No. 6 Oil	:	7,223	5,942	3,201	4,022
No. 2 Oil	:	84,790	52,371	26,973	57,817
Coal	:	50,292	39,312	28,265	22,027
				TOTAL SAVINGS =	68,571

In constant FY 80 dollars, the cost of Miesau Ammo Depot's energy is projected to be $799,500 as compared to $1,258,300 : a savings of $458,800 per year in 1980 dollars.

4.1 ECIP Projects

Project documents have been prepared for energy conservation measures which qualify for ECIP funding. Volume III of the report contains completed DD Forms 1391 and Project Development Brochures for these projects. See Table 4.1.

The implementation of the energy conservation measures developed for ECIP funding will require an investment of $675,000 and result in an annual savings of 24,381 MBTU/yr. Assuming a discount rate of 10%, the discounted payback for the total investment would be 3.5 years.

TABLE 4.1

SUMMARY OF RECOMMENDED ECIP PROJECTS

PROJECT DESCRIPTION	ENERGY SAVED (MBTU/YR)	ENERGY SAVED ($/YR)	TOTAL INVESTMENT ($)	ESIR
ECIP WEATHERIZATION (OMA Facilities)	16,632	111,763	441,540	3.01
o Weatherstripping				
o Vestibules				
o Roof Insulation				
o Double Glazing				
o Thermal Barriers for Windows				
ECIP ENERGY CONSERVATION IMPROVEMENTS (OMA Facilities)	7,749	43,762	233,550	2.11
o Lighting System Replacement				
o Thermostatic Radiator Valves				
o Building LPS Controls				
o Prevent Air Stratification				
o Install Flue Gas Dampers				
o Install Turbulators				
o Install Boiler Combustion Controls				
o Install Heat Pump for DHW Generation				
	24,381	155,525	675,090	

4.2 Specific Operation and Maintenance Modifications

Recommendations for modification of the operation and maintenance of utility systems were developed from building operations survey data. These energy conservation measures are expected to save 2,537 MBTU/yr for a total investment of $11,028: at an estimated savings of $15,124/yr the investment will payback in less than 9 months. See Table 4.2.

4.3 General Operation and Maintenance Modifications

General opportunities for conservation in the operation and maintenance of utilities systems which have been recommended are summarized below:

PROJECT DESCRIPTION	ENERGY SAVINGS (MBTU/yr)	MATERIAL COST ($)	LABOR HOURS (HOURS)
Night Temperature Setback The energy savings attainable through night and weekend temperature setback of intermittently occupied buildings was not applied to the ECIP projects for building heating system controls. After the controls are installed, setback of indoor temperature during unoccupied periods can be implemented for additional heating energy savings.	15,615	-	40
Domestic Hot Water Flow Control Where flow rates through shower heads and faucets are excessive, flow control devices are being installed to limit energy consumption.	2,808	2,000	96

Table 4.2

INCREMENT F:

OPERATION AND MAINTENANCE MODIFICATIONS

BLDG	CONSERVATION OPTION	MBTU/YR	$/YR	TOTAL COST	ESIR	SIR	MANHOURS	L.T.	REF.
1304	Reduce DHW Temperature	314	2,355	12	2,433.7	2,433.7	1	1	04
1339	Reduce DHW Temperature	143	421	12	590.0	590.0	1	1	04
1338	Reduce DHW Temperature	117	345	12	482.8	482.8	1	1	04
1625	Reduce DHW Temperature	83	406	12	407.0	407.0	1	1	36
1216	Reduce DHW Temperature	46	346	12	358.0	358.0	1	1	04
1630	Reduce DHW Temperature	73	357	12	357.2	357.2	1	1	36
1325	Reduce DHW Temperature	82	243	12	339.7	339.7	1	1	04
1348	Reduce DHW Temperature	74	217	12	304.0	304.0	1	1	04
1445	Reduce DHW Temperature	54	265	12	265.8	265.8	1	1	36
1684	Reduce DHW Temperature	53	259	12	259.2	259.2	1	1	36
1204	Stop Heat Unnoc. Space	47	354	24	183.0	183.0	2	1	10
1447	Reduce DHW Temperature	17	124	12	128.3	128.3	1	1	04
1237	Disconnect Water Cooler	20	99	11	110.9	110.9	1	2	32
1210	Reduce DHW Flow	858	6,442	977	83.2	83.2	40	1	05
1552	Lamp Photocell	42	204	105	23.8	23.8	4	2	41
1375	Timer Vending Machine	15	71	58	14.9	14.9	2	2	34
1311	Outdoor Lamp Photocell	21	102	105	11.9	11.9	4	2	42
1338	Repair Faucet Leak	5	15	24	10.7	10.7	2	1	06
1301	Repair 4 Vent Dampers	38	286	342	10.6	10.6	8	1	01
1311	Delamp 16 Fixtures	15	75	87	10.5	10.5	8	2	38
1375	Delamp Hall Fixtures	4	19	22	10.5	10.5	2	2	38
1553	Repair Vent Damper	17	64	110	9.9	9.9	4	1	01
1510	Delamp Hall Fixture	7	33	44	9.2	9.2	4	2	38
1557	Delamp Hall Fixtures	7	33	44	9.2	9.2	4	2	38
1447	Repair Vent Damper	16	77	110	8.9	8.9	4	1	01
1414	Lamp Photocell	14	68	105	7.9	7.9	4	2	41
1216	Delamp 3 Fixtures	3	14	22	7.9	7.9	2	2	38
1516	Delamp Spray Booth	6	28	44	7.9	7.9	4	2	38
1343	Bath Light Timers	11	54	93	7.2	7.2	4	2	40
1361	Remove 14 Shades	10	47	87	6.6	6.6	8	2	37
1237	Timer On Vending Machine	6	31	58	6.4	6.4	2	2	33
1345	Timer on Vending Machine	6	31	58	6.4	6.4	2	2	34
1361	Timer Vending Machine	6	31	58	6.4	6.4	2	2	34
1330	Bath Light Timers	10	48	93	6.3	6.3	4	2	40
1331	Bath Light Timers	10	48	93	6.3	6.3	4	2	40
1332	Bath Light Timer	10	48	93	6.3	6.3	4	2	40
1338	Bath Light Timers	10	48	93	6.3	6.3	4	2	40
1339	Bath Light Timers	10	48	93	6.3	6.3	4	2	40
1344	Bath Light Timers	10	48	93	6.3	6.3	4	2	40
1593	Bath Light Timer	5	23	46	6.0	6.0	2	2	40
1370	Remove 24 Light Shades	12	59	131	5.5	5.5	12	2	37
1375	Bath Light Timer	4	18	46	4.8	4.8	2	2	40
1361	Light Timers	12	58	161	4.4	4.4	8	2	40
1220	Add BAth Fan Damper	5	36	110	4.2	4.2	4	1	01
1376	Remove 155 Shades	60	294	875	4.1	4.1	80	2	37

Table 4.2 (Continued)

INCREMENT F:

OPERATION AND MAINTENANCE MODIFICATIONS

BLDG	CONSERVATION OPTION	MBTU/YR	$/YR	TOTAL COST	ESIR	SIR	MANHOURS	L.T.	REF.
1429	Repair Vent Dampers	9	67	220	3.8	3.8	8	1	01
1400	Add Vent Fan Damper	4	33	110	3.8	3.8	4	1	01
1518	Repair Radiator Valve	4	15	73	3.6	3.6	2	1	08
1330	Laundry Light Timer	3	14	46	3.6	3.6	2	2	40
1331	Laundry Light Timer	3	14	46	3.6	3.6	2	2	40
1332	Laundry Light Timer	3	14	46	3.6	3.6	2	2	40
1338	Laundry Light Timer	3	14	46	3.6	3.6	2	2	40
1339	Laundry Light Timer	3	14	46	3.6	3.6	2	2	40
1344	Laundry Light Timer	3	14	46	3.6	3.6	2	2	40
1557	Install 2 Vent Dampers	8	30	159	3.2	3.2	8	1	01
1343	Replace 2 Radiator Valves	11	32	195	2.8	2.8	8	1	08
1259	Remove 80 Shades	19	94	437	2.6	2.6	40	2	37
1592	Install 2 Vent Dampers	5	28	159	2.6	2.6	8	1	01
1682	Add 2 Vent Fan Dampers	4	33	159	2.6	2.6	8	1	01
1330	Locker Room Light Timer	2	9	46	2.4	2.4	2	2	40
1216	Timer In Vending Machine	6	31	175	2.1	2.1	6	2	33
1364	Light Timers	3	16	93	2.1	2.1	4	2	40
1259	Add 3 Lamp Switches	12	59	358	2.0	2.0	16	2	39
1325	Bath Light Timers	5	22	139	1.9	1.9	6	2	40
1326	Bath Light Timers	5	22	139	1.9	1.9	6	2	40
1327	Bath Light Timers	5	22	139	1.9	1.9	6	2	40
1376	Add 4 Light Switches	10	51	419	1.5	1.5	16	2	39
1237	Reduce DHW Flow	3	26	293	1.1	1.1	12	1	05
1216	Insulate Steam Valves	9	69	801	1.1	1.1	6	3	03
1348	Add Lamp Switch	2	9	149	.7	.7	8	2	39
1210	Insulate Steam Valves	7	54	1,151	.6	.6	10	3	03
1206	Insulate Steam Valves	4	26	691	.5	.5	6	3	03

4.4 Recommendations for Electrical Load Management

Management of electrical loads creates opportunities for reducing operating costs. The methods recommended do not conserve a significant amount of energy but rather control the use of electrical energy in order to take fair advantage of utility rate schedules. The recommendations are summarized below.

	COST SAVINGS ($/yr)	INVESTMENT ($)
1. Load Shedding A demand limiting (ripple) control system can be installed to reduce peak demand utility charges by temporarily disconnecting certain loads during peak demand periods.	$18,800	105,200

2. Use of Standby Generators
If 50% of the presently installed standby generators were operated parallel with the utility for approximately four hours each day in January to lower the annual peak demand, the rate paid for electrical energy throughout the year would be lowered. If policy could be changed to permit the use of generators in this manner, annual savings would be estimated to be: $7,500

	COST SAVINGS ($/yr)	INVESTMENT ($)
3. Power Factor Correction Miesau Ammo Depot consistently operates at a high power factor; hence, there are no savings possible by the addition of PF correction devices.	-	-
4. Optimum Transformer Loading Transformer losses can be reduced by maintaining transformer loading in the most economical loading range. As discussed in Section 7.4 of Volume II, transformer loading is currently at optimum for the system arrangement.	-	-
TOTAL	$18,800/yr	105,200

4.5 Summary of Energy and Cost Savings

Potential energy and utility cost savings for Miesau Ammo Depot are summarized below.

	Energy Savings (MBTU/yr)	Cost Savings ($/yr)
ECIP Projects	24,381	155,525
Specific Operation and Maintenance Recommendations	2,537	15,124
General Operation and Maintenance Recommendations	18,423	115,368
Recommendations for Load Shedding		18,800
	TOTAL	$304,817

5.0 SPECIAL APPROACHES TO ENERGY UTILIZATION

Part of the EEA effort was directed toward special approaches to energy utilization with the goal of reducing dependency on critical fuels as well as reducing energy consumption. Renewable energy sources including solar, biomass, geothermal, wind and waste have general potential to replace petroleum and natural gas as fuels for space heating and hot water. For the current Miesau Ammo Depot applications waste-to-energy, geothermal and solar appeared to be technically feasible renewable energy sources. Other special approaches which have been successfully applied elsewhere were analyzed but found inappropriate for the specific application factors at Miesau Ammo Depot. In general, alternative sources are most attractive when replacing oil, natural gas or electric energy and are least attractive when replacing coal; DOD's push to increase coal usage makes it more difficult for these alternatives to compete.

The conclusions of the various energy utilization approaches evaluated are summarized below:

Opportunity Investigated	Conclusion
Utilization of Wind Energy	Average wind velocities are too low for practical applications.
Geothermal Energy	Geological conditions in this area lend themselves to probable application for a geothermal/heat pump system; however, sufficient data on geothermal deposits is unavailable.
Biomass (Fuel Derived from Plant Life)	This technology is not commercially developed and the availability of fuel stock is unreliable.
Waste-to-Energy Systems - Refuse Derived Fuel	There is no network in Miesau Ammo Depot which has a sufficient base load for burning the refuse collected. Therefore, in light of the high investment costs, it is not possible to operate the facility for sufficient hours per year to make it economical.

Opportunity Investigated	Conclusion
Waste-to-Energy Systems (Cont'd)	
- Biogas	Biogas is not competitive with fossil fuels and does not have a potential for utilization in Miesau Ammo Depot.
- Sewage Gas	Cost effective utilization of sewage gas is not possible. If a new sewage plant is constructed or major renovations made for other purposes, the utilization of sewage gas appears attractive.
- Pyrolysis of Municipal Refuse	This technology has not advanced far enough to be considered for commercial development.
Coal/Oil Mixtures	This technology is being developed for commercial demonstration. This fuel is not now available for commercial purchase.
Solar Energy	The most appropriate application of this proven technology is for heating domestic water. Analysis concluded that this application was not life cycle cost effective by ECIP criteria for five buildings having the greatest application potential.
District Heating	Utilization of municipal district heating is very common in West Germany but no systems are located in the vicinity of Miesau Ammo Depot.

what break even point should be used as an indicator for possible reconsideration of this opportunity

explain in greater detail elsewhere in text?

EMCS applications studied for the Miesau Ammo Depot resulted in the recommendation of localized EMCS in the form of building heating system controls (MICRO Systems) and remote limited function EMCS for peak demand limiting. The heating system controls bring significant energy savings to be incorporated in the ECIP projects. The demand limiting EMCS reduces utility charges but does not significantly save energy; this project must be funded through sources other than ECIP.

6.0 ENERGY PLAN

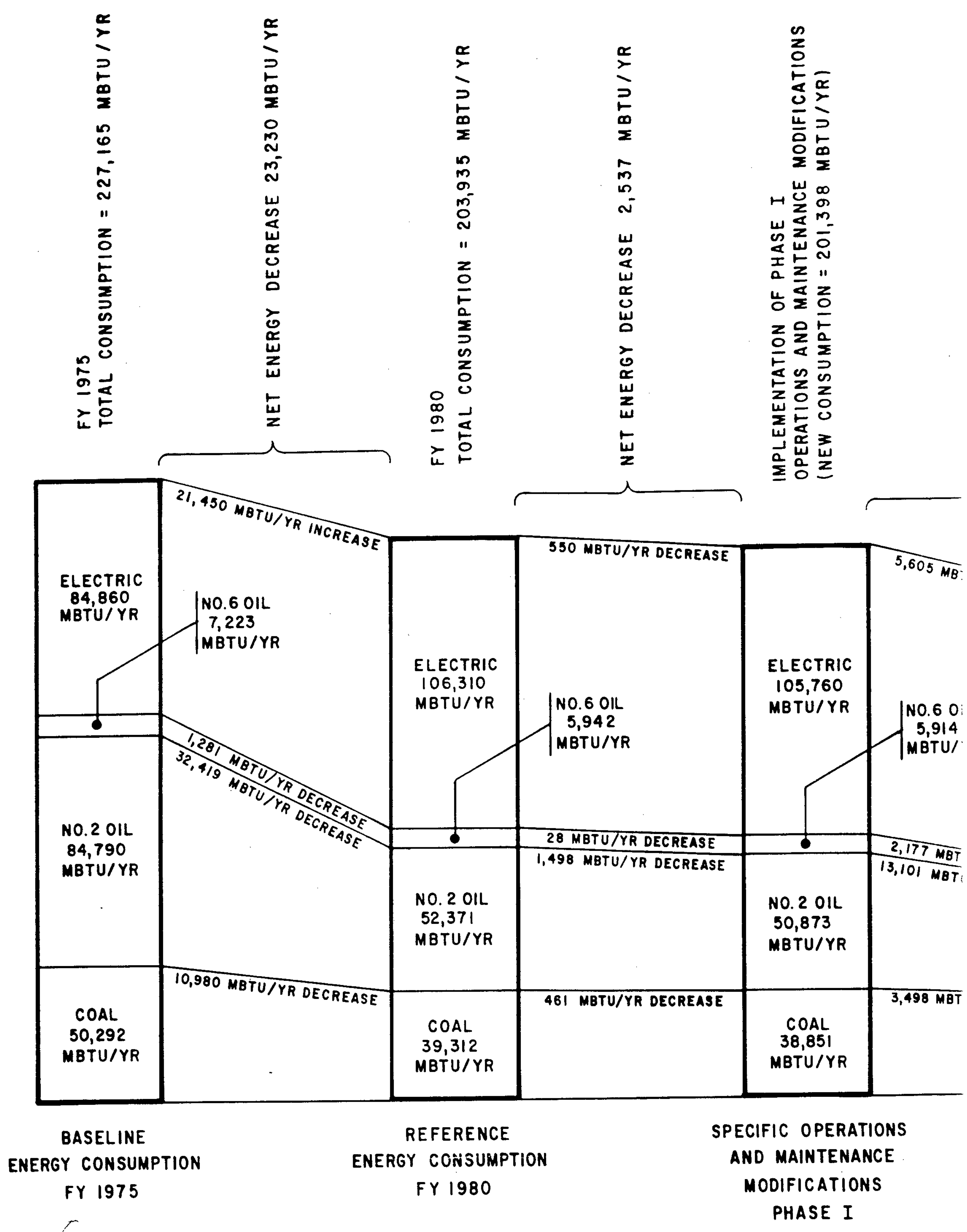
The "Basewide Energy Plan" as developed hereunder integrates ongoing energy conservation operations and maintenance activities, programmed ECIP Projects, programmed projects (which save energy) in the OMA, MMCA, MCA and FH categories and EEAP Study recommendations in both the operations and maintenance category and the capital (ECIP) improvement category.

Figure 6.1 graphically depicts the implementation of the following energy plan. Figure 6.2 shows the energy consumption/energy savings profile as a function of time. The baseline data is as follows:

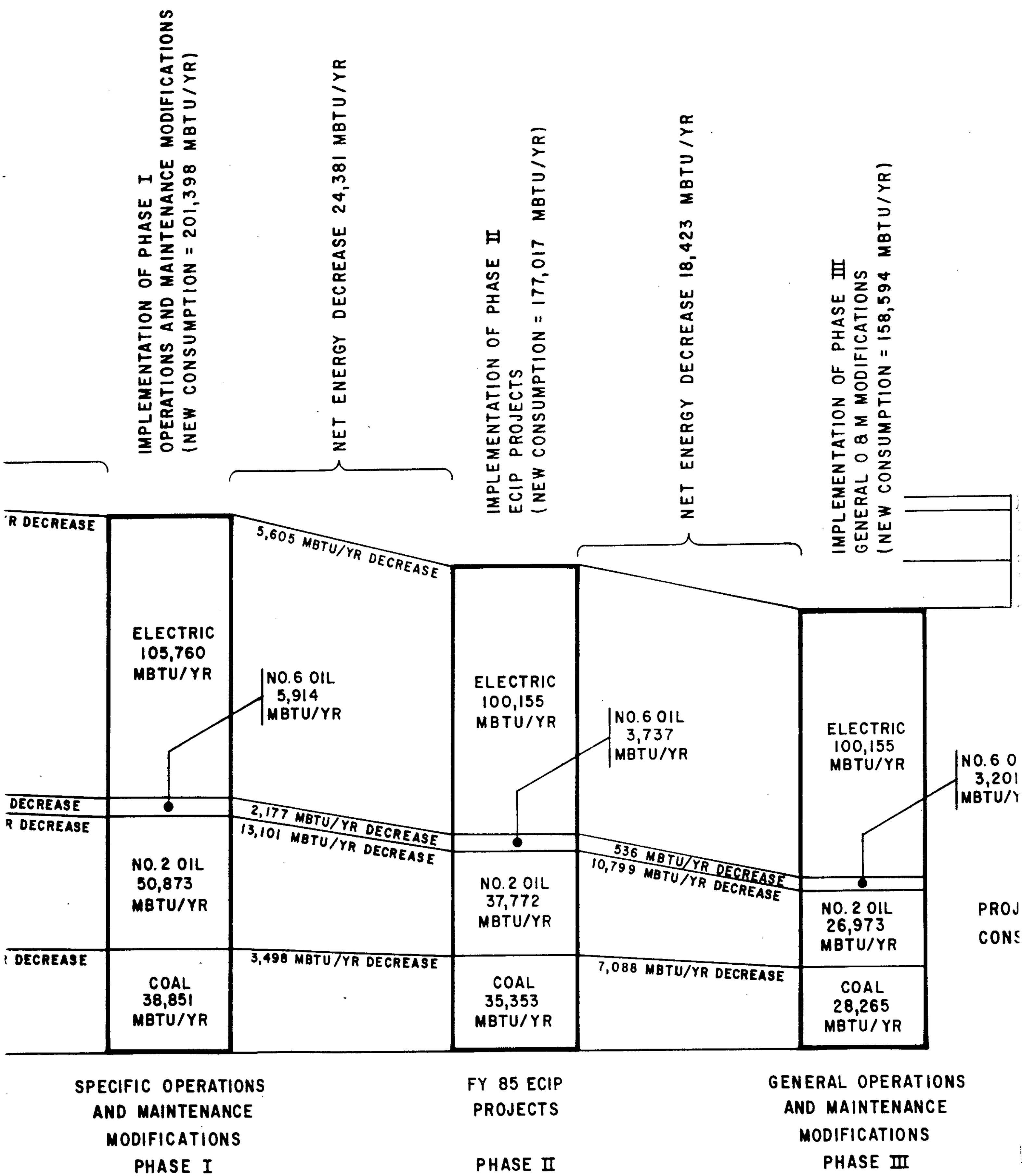
FY 75 BASELINE ENERGY CONSUMPTION	: 227,165 MBTU/YR
CRITICAL FUEL OIL CONSUMPTION	: 92,013 MBTU/YR
ENERGY BUDGET KBTU/SF - YR	: 188.8

The reference year for this study is FY 80. The available data indicates that community energy conservation activities were able to effectively reduce total energy consumption as follows:

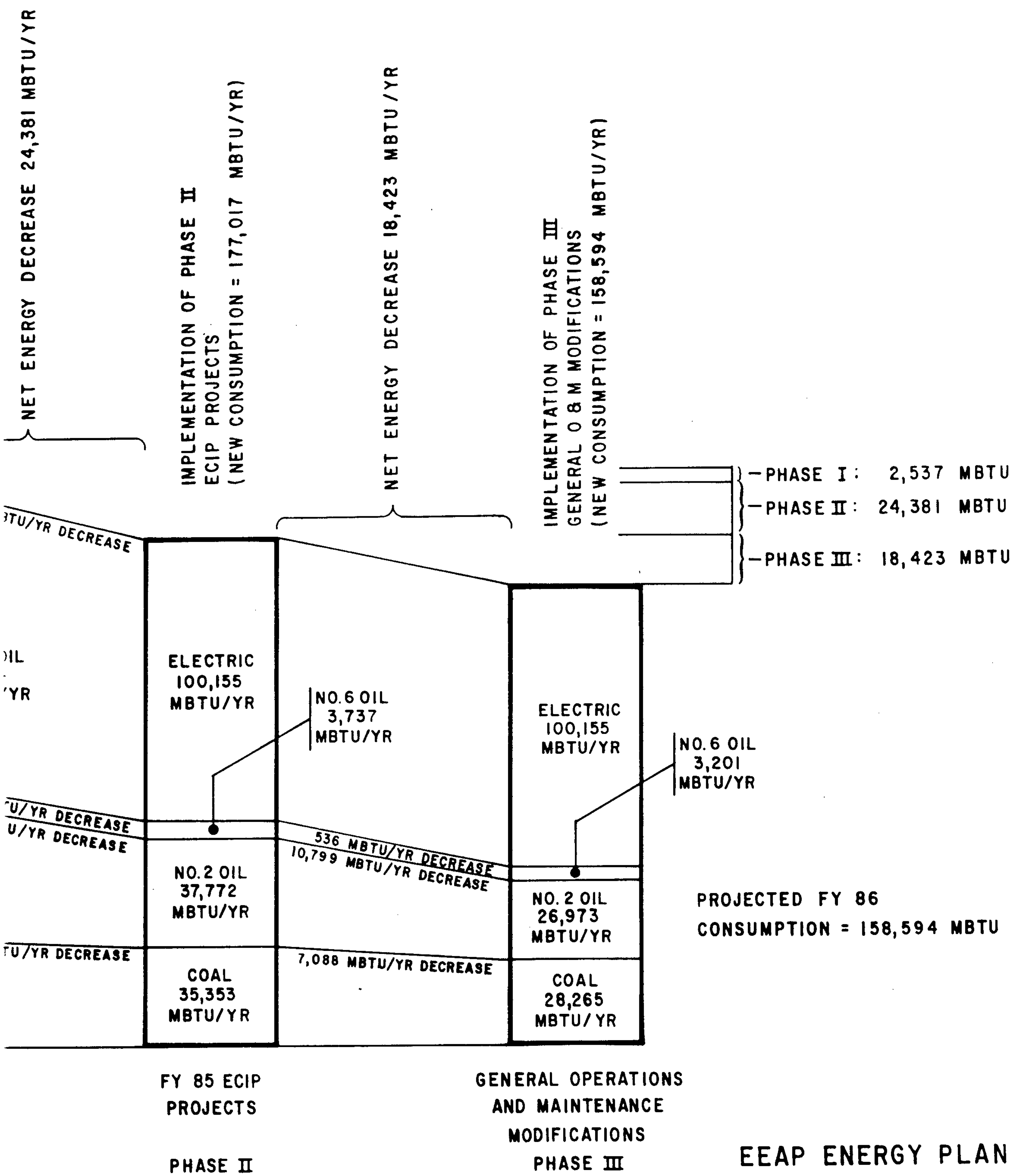
FY 80 REFERENCE ENERGY CONSUMPTION	: 203,935 MBTU/YR
% REDUCTION FROM BASELINE	: 10.2%
FY 80 CRITICAL FUEL OIL CONSUMPTION	: 58,313 MBTU/YR
ENERGY BUDGET KBTU/SF - YR	: 169.5


FY 1975
TOTAL CONSUMPTION = 227,165 MBTU/YR
NET ENERGY DECREASE 23,230 MBTU/YR
FY 1980
TOTAL CONSUMPTION = 203,935 MBTU/YR
NET ENERGY DECREASE 2,537 MBTU/YR
IMPLEMENTATION OF PHASE I
OPERATIONS AND MAINTENANCE MODIFICATIONS
(NEW CONSUMPTION = 201,398 MBTU/YR)
ELECTRIC 84,860 MBTU/YR
NO.6 OIL 7,223 MBTU/YR
NO.2 OIL 84,790 MBTU/YR
COAL 50,292 MBTU/YR
21,450 MBTU/YR INCREASE
1,281 MBTU/YR DECREASE
32,419 MBTU/YR DECREASE
10,980 MBTU/YR DECREASE
ELECTRIC 106,310 MBTU/YR
NO.6 OIL 5,942 MBTU/YR
NO.2 OIL 52,371 MBTU/YR
COAL 39,312 MBTU/YR
550 MBTU/YR DECREASE
28 MBTU/YR DECREASE
1,498 MBTU/YR DECREASE
461 MBTU/YR DECREASE
ELECTRIC 105,760 MBTU/YR
NO.6 OIL 5,914 MBTU/YR
NO.2 OIL 50,873 MBTU/YR
COAL 38,851 MBTU/YR
5,605
2,177
13,101
3,498
BASELINE
ENERGY CONSUMPTION
FY 1975
REFERENCE
ENERGY CONSUMPTION
FY 1980
SPECIFIC OPERATIONS
AND MAINTENANCE
MODIFICATIONS
PHASE I

1


IMPLEMENTATION OF PHASE I
OPERATIONS AND MAINTENANCE MODIFICATIONS
(NEW CONSUMPTION = 201,398 MBTU/YR)
NET ENERGY DECREASE 24,381 MBTU/YR
IMPLEMENTATION OF PHASE II
ECIP PROJECTS
(NEW CONSUMPTION = 177,017 MBTU/YR)
NET ENERGY DECREASE 18,423 MBTU/YR
IMPLEMENTATION OF PHASE III
GENERAL O & M MODIFICATIONS
(NEW CONSUMPTION = 158,594 MBTU/YR)
R DECREASE
DECREASE
R DECREASE
DECREASE
ELECTRIC
105,760
MBTU/YR
NO.6 OIL
5,914
MBTU/YR
NO. 2 OIL
50,873
MBTU/YR
COAL
38,851
MBTU/YR
5,605 MBTU/YR DECREASE
2,177 MBTU/YR DECREASE
13,101 MBTU/YR DECREASE
3,498 MBTU/YR DECREASE
ELECTRIC
100,155
MBTU/YR
NO.6 OIL
3,737
MBTU/YR
NO. 2 OIL
37,772
MBTU/YR
COAL
35,353
MBTU/YR
536 MBTU/YR DECREASE
10,799 MBTU/YR DECREASE
7,088 MBTU/YR DECREASE
ELECTRIC
100,155
MBTU/YR
NO.6 O
3,201
MBTU/Y
NO. 2 OIL
26,973
MBTU/YR
COAL
28,265
MBTU/ YR
PROJ
CONS
SPECIFIC OPERATIONS
AND MAINTENANCE
MODIFICATIONS
PHASE I
FY 85 ECIP
PROJECTS
PHASE II
GENERAL OPERATIONS
AND MAINTENANCE
MODIFICATIONS
PHASE III

2



EEAP ENERGY PLAN

FIGURE 6.1

3

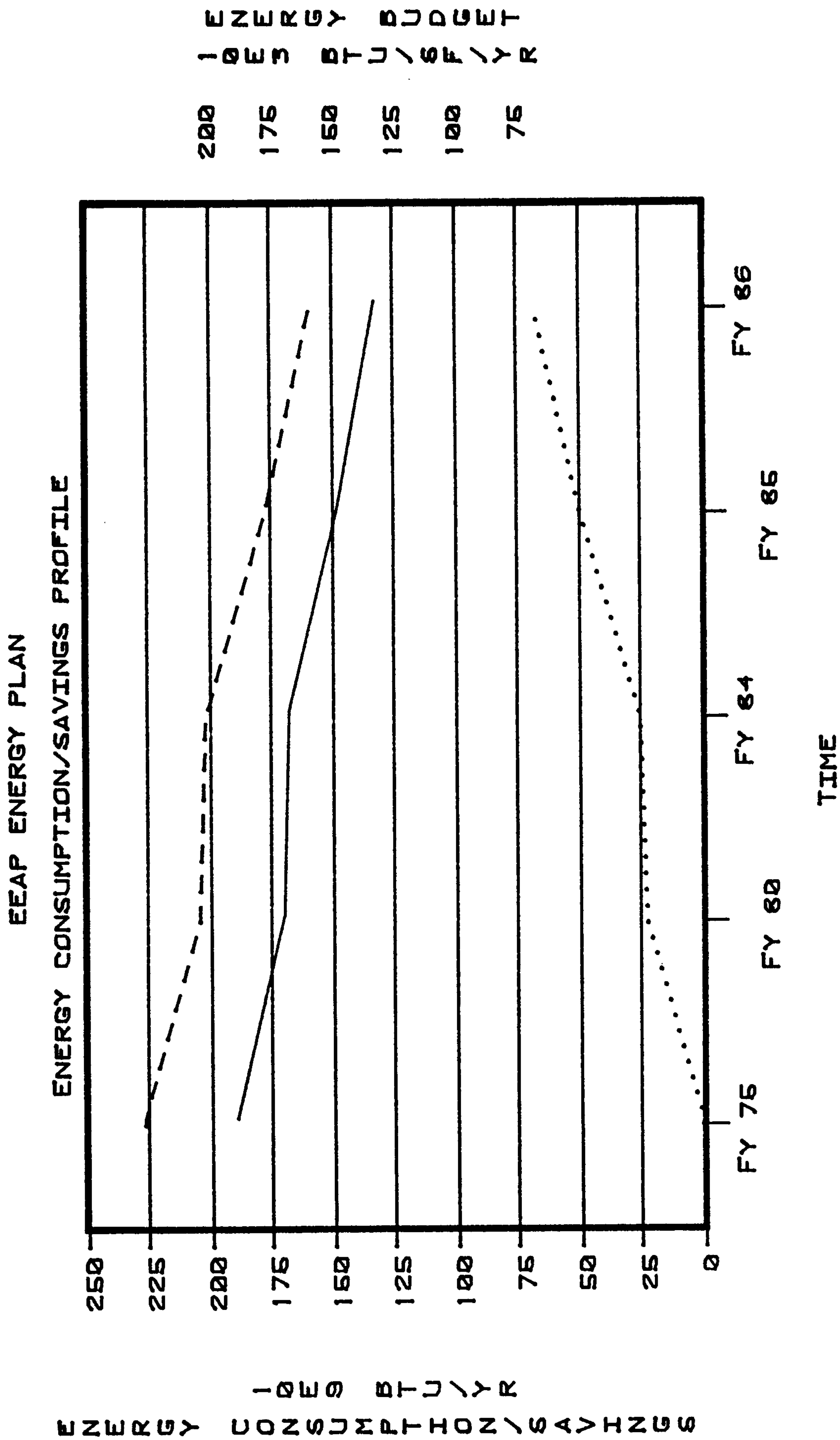

EEAP ENERGY PLAN
ENERGY CONSUMPTION/SAVINGS PROFILE
ENERGY BUDGET
10E3 BTU/SF/YR
200
175
150
125
100
75
ENERGY CONSUMPTION/SAVINGS
10E9 BTU/YR
250
225
200
175
150
125
100
75
50
25
0
FY 76
FY 80
FY 84
FY 85
FY 86
TIME

FIGURE 6.2

Phase I of the energy plan is the implementation of specific operations and maintenance type modifications. Using in-house labor these modifications can be made relatively quickly and can be done inexpensively; collectively, they will yield a payback of less than nine months and reduce the total annual energy consumption as follows:

Upon Completion of Phase I:

TOTAL ENERGY CONSUMPTION	: 201,398 MBTU/YR
% REDUCTION (CUMULATIVE) FROM BASELINE	: 11.3%
CRITICAL FUEL OIL CONSUMPTION	: 56,787 MBTU/YR
ENERGY BUDGET KBTU/SF - YR (10^3)	: 167.4

Phase II of the energy plan is a part of the ongoing energy conservation efforts of Zweibruecken Military Community. The anticipated savings for this phase are derived from those projects which have already been programmed by the community and are in various stages of approval, design or construction. A savings projection, for those projects listed in Section 3, is not available.

Phase II also includes the implementation of energy conservation measures recommended herein and chosen by the community for implementation. Project documentation has already been developed for Phase II projects and been sent forward for approval as FY 85 projects. The savings projection for this phase is 24,381 MBTU/yr. The reduction of total annual energy consumption is as follows:

Upon Completion of Phase II :

TOTAL ENERGY CONSUMPTION	: 177,017 MBTU/YR
% REDUCTION (CUMULATIVE) FROM BASELINE	: 22.1%
CRITICAL FUEL OIL CONSUMPTION	: 41,509 MBTU/YR
ENERGY BUDGET KBTU/SF - YR	: 147.1

Phase III of the energy plan is the implementation of general operations and maintenance type measures. Most of these measures have not been quantified because they are either accomplished during the normal course of maintenance, are maintenance activities necessary to maintain level of savings achieved through other energy savings measures or are monitoring activities which are necessary in order to achieve success in any energy conservation plan. These general operations and maintenance type measures are discussed in Sections 6.3 and 6.4. The savings projection for this phase is 18,423 MBTU/yr. The reduction of total annual energy consumption is as follows:

Upon Completion of Phase III:

TOTAL ENERGY CONSUMPTION	: 158,594 MBTU/YR
% REDUCTION (CUMULATIVE) FROM BASELINE	: 30.1%
CRITICAL FUEL OIL CONSUMPTION	: 30,174 MBTU/YR
ENERGY BUDGET KBTU/SF - YR	: 131.8

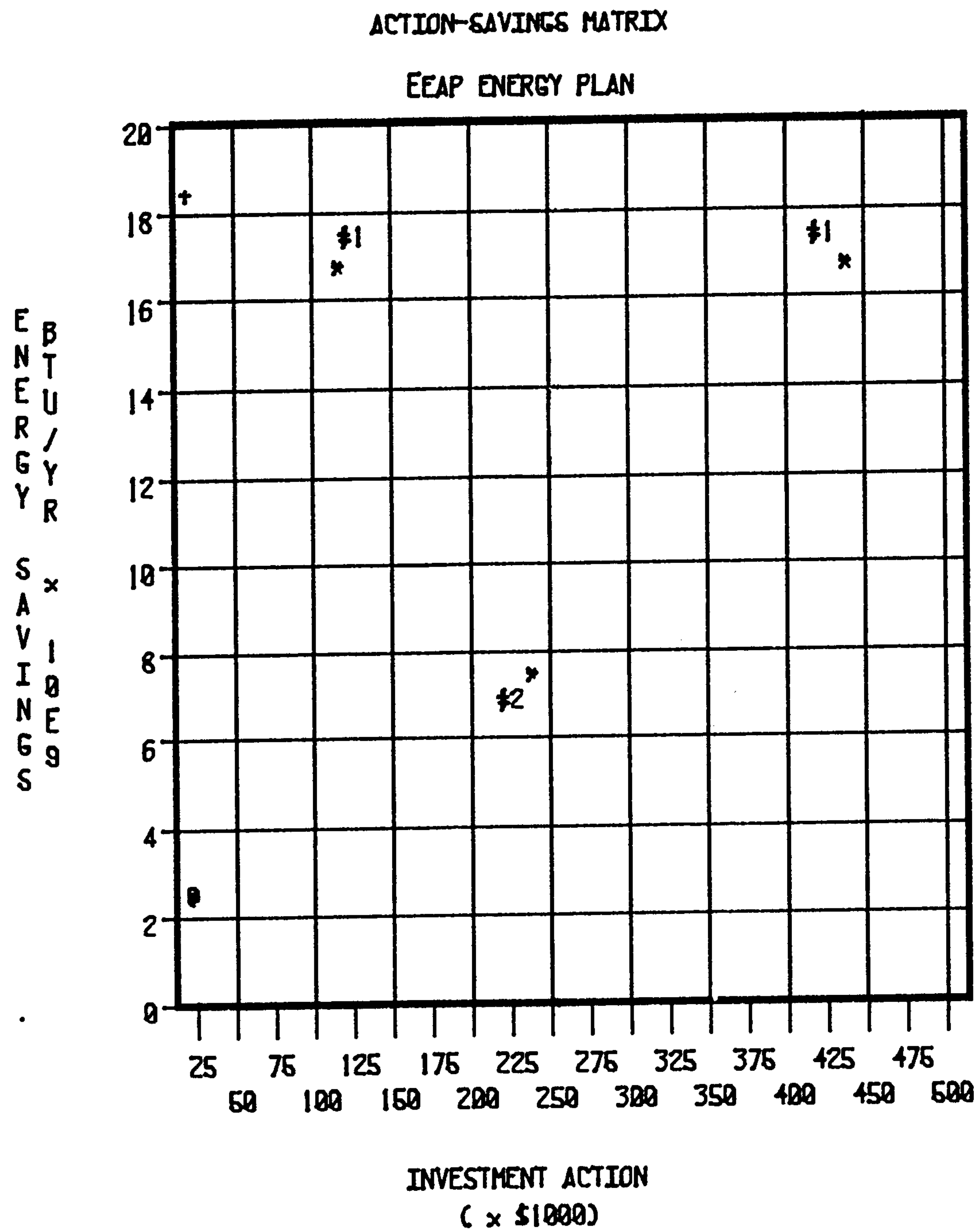
Implementation of this energy conservation plan will result in several coincident energy reductions on the same buildings. Care was taken so as not to duplicate energy savings within the secondary systems or between the primary and secondary systems; therefore, in view of the conservative approach taken in energy savings calculations, the predicted savings are achievable. However, a program for monitoring the progress of the energy plan and gauging the savings is of the utmost importance; this is necessary to identify problems in meeting goals as early on in the program as is feasible.

Figure 6.3 presents a matrix of the energy conservation projects versus savings and costs.

6.1 Army Facilities Energy Plan Goals

The above described plan was developed to reduce energy consumption at Miesau Ammo Depot in accordance with the goals of the Army Facilities Energy Plan.

A comparison of the goals of the Army Facilities Energy Plan and the findings and results of this study is made in Table 6.4.



LEGEND
@ - SPECIFIC OPERATION AND MAINTENANCE ECO'S
* - ECIP DD FORMS 1391: #1:ECIP WEATHERIZATION-OMA (ESIR=3.01)
#2:ECIP ENERGY CONS. IMPROVEMENTS-OMA (ESIR=2.11)
+ - GENERAL OPERATIONS AND MAINTENANCE ECO'S

FIGURE 6.3

TABLE 6.4

	ARMY FACILITIES ENERGY PLAN	EEAP ENERGY PLAN
YEAR 1985 GOALS	a. Reduce Army installation and activity energy consumption by 25% of that consumed in FY 75 as the base year.	a. Energy consumption reductions to date in combination with recommended operations and maintenance modifications and recommended ECIP projects will serve to reduce annual consumption by approximately 30%.
	b. Reduce average annual energy consumption per gross square foot of floor area by 20% in existing facilities compared to FY 75 as the base year. At least 12% of the energy reduction in existing buildings shall be accomplished through energy conservation projects under the Energy Conservation Investment Program (ECIP).	b. The average annual energy consumption will be reduced from 188,800 BTU/SF - YR to 131,800 BTU/SF - YR upon complete implementation of the plan; this is a 30.1% reduction. The EEAP ECIP projects will save an estimated 11% of FY 75 consumption of existing facilities; this coupled with community-programmed ECIP projects should meet the goal.
	c. Reduced average annual energy consumption per gross square foot of floor area by 45% in new buildings compared to FY 75 as the base year.	c. This shall be accomplished by proper review and monitoring throughout the design phase.
	d. Reduce dependence on critical fuels:	d.
	1. Obtain at least 10% of total Army installation energy from coal, coal gasification, solid waste, refuse derived fuel and biomass.	1. Over 42.8% of the existing facilities are currently heated by coal.
	2. Equip all natural gas only heating units and plants over 5 MEGA BTU per hour output with the capability to use oil or other alternate fuels.	2. Miesau Ammo Depot does not have any natural gas only heating units over 5 MEGA BTU.
	3. To have on hand at the beginning of each heating season a 30-day fuel supply for all oil only, oil - natural gas, and coal heating units over 5 MEGA BTU per hour output based upon the coldest month recorded and in a mobilization condition.	3. This shall be accomplished through implementation of proper procurement regulations.
	4. Obtain 1% of total Army installation energy by solar means.	4. Based on analysis of solar applications for Miesau Ammo Depot, solar energy projects should be concentrated in other geographical areas where the project economics are expected to be very attractive.
	5. Restrict the use of electric resistance heating to those applications prescribed in ETL 1110-3-254.	5. Survey data did not indicate that electric resistance heating was being used in Miesau Ammo Depot. In facilities where building heating control systems had been installed, use of portable electric heaters in barracks was reported. This illustrates the need to institute tight controls over unauthorized use of private electric resistance heaters.
	6. Require the energy efficiency ratios of new windows air conditioning units to be 8.5 or greater for 120 volt units and 8.0 or greater for 230 volt units.	6. Air conditioning units are not generally installed at Miesau Ammo Depot. Recommendations for purchase of energy conservation design options on replacement equipment are included in Section 6 of Volume II.

TABLE 6.4 (Continued)

	ARMY FACILITIES ENERGY PLAN	EEAP ENERGY PLAN
YEAR 2000 GOALS	a. Reduce Army installation and activity energy consumption by 50% of that consumed in FY 75.	a. This goal, although difficult to attain, is within reach. By implementing the EEAP Plan, the existing structures and utility systems will have been modified with those conservation measures now practical; this will reduce FY 75 energy consumption by 30%. Through proper maintenance, these savings should be maintained through 2000. The additional 20% savings will be achieved by the construction of new more efficient facilities, replacement of inefficient equipment through attrition and general maintenance and operations measures (not quantified) discussed in Volume II; heating plants should be the primary targets for replacement of existing equipment with higher efficiency equipment.
	b. Reduce dependence on critical fuels. 1. Eliminate use of natural gas. 2. Reduce the use of petroleum fuels in installations operations by 75%.	b. These goals can be met through conventional technology. The EEAP Plan shows a reduction of 40% in critical fuels. The most logical approach to further reduction in critical fuels would be repair by replacement and consolidation of oil-fired heating plants (oil to coal conversion).